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The Availability of Risk Capital for Technological Innovation and Invention in Canada

by Robert H. Grasley

Ministry of State
Science and Technology

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TO THE READERS OF: "The Availability of Risk Capital for Technological Innovation and Invention in Canada"

This background paper, which has been prepared for the Ministry of State for Science and Technology by a consultant, attempts to look at the Canadian financial environment for technological innovation and invention in Canada. The report was commissioned because of the Ministry's concern for the creation for an environment conducive to the development of an indigenous technological capability in Canada which will contribute to the country's social and economic goals. In order to formulate policy to these ends it is necessary to explore the problems which inhibit Canadian inventors and innovators from successfully bringing their ideas, products and processes to the marketplace. This report is part of that exploration.

The report, which represents the views of the author and not necessarily the views of the government, is being published in the hopes that it will provide a useful contribution to the subject and that it will initiate a dialogue with interested parties so that whatever policies are ultimately recommended to the government will accurately respond to Canada's needs in this area. The author has come to a number of conclusions and made a series of recommendations which are thought-provoking, and these are being published along with the report.

I would welcome comments on the study and its recommendations and these should be addressed to the Policy Branch of the Ministry.

C.M. Drury

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THE AVAILABILITY OF RISK CAPITAL FOR TECHNOLOGICAL INNOVATION AND INVENTION IN CANADA

In order to assess the capital aspects of technological innovation, the entire process is examined and then divided into three prime areas of activity: Inventive, Entrepreneurial and Managerial. These activities, even though they are an integral part of the innovation chain, are viewed as separate and specialized phases. Analysis of capital availability in Canada is then approached from the viewpoint of each activity.

The Canadian capital market is examined to determine; a) funding capability, b) investor attitudes and c) past and present trends. The author has concluded that ''risk-aversion'' is prevalent and widespread in Canada, as evidenced by the preference of individual and institutional investors for debt and senior equity securities.

Technological innovation is uncommon in most large firms, not due to capital shortages, but because of the inherent make-up and attitudes of most professional managers. On the other hand, small companies, entrepreneurs and individual inventors who tend to be very innovative, have a great deal of difficulty reaching the capital market. Therefore, lack of financial support is severely constraining innovation in Canada.

This conclusion was confirmed when the 77 firms making venture capital investments in Canada were surveyed. In spite of the increased number of venture capital firms operating in Canada in the past few years, the reported current (Feb./March 1974) availability of funds for investment was only $66.0 million. A June 1971 study surveyed 44 venture capital firms, of which 17 reported an availability of approximately $64.0 million. That same group of 17 firms today reported an availability of only $3.35 million for investment. This indicates a marked decline in funds available for investment from the venture capital industry in Canada.

Moreover, only 23 firms indicated a willingness to finance start-ups, with an estimated $2.0 million available for this purpose. When their figures were analysed further, only $650,000 appeared to be available to finance all technologically-oriented start-ups in Canada. The author therefore concludes that there is a severe shortage of high-risk investment funds available in Canada to support technological ventures. Lack of funds is not the only inhibiting factor, as the study points out, but it is undoubtedly the major factor.

The role played by inventors in the innovation chain is examined and the great difficulty encountered by small firms, entrepreneurs and private inventors when trying to obtain financing is highlighted. While most inventors expend substantial funds to develop their inventions ($6,186 reported average per invention and $39,950 lifetime average per inventor), there is no formalized national organization in Canada willing and able to provide development capital to bring these inventions to a stage where they may be commercially exploited.

The author concludes that, considering the risk-averse attitudes prevalent in Canada and the shortage of high-risk investment funds available, a system of risk reduction is necessary to increase the flow of funds into this area. The Income Tax Act appears to provide the best opportunity to accomplish this and appropriate recommendations have been made.

Abstract of:

THE AVAILABILITY OF RISK CAPITAL FOR TECHNOLOGICAL INNOVATION AND INVENTION IN CANADA

This study attempts to break the innovation process into its component parts and to examine the capital markets available in Canada for each activity: Inventive, Entrepreneurial and Managerial. The information presented is a compilation of fact and opinion abstracted from interviews and conversations with nearly 200 venture capitalists, businessmen, bankers, financiers, provincial and federal government officials and consultants. In addition, some 60 inventors were interviewed and over 200 were contacted by mail. Seventy-seven venture capital firms and firms which have made venture capital investments were surveyed and 82 inventors responded to a questionnaire about their activities.

The financial climate in Canada is commented on generally with detailed discussion on early financing for technological innovation, start-ups and invention.

Definition Of Innovation

Innovation is defined as the successful introduction on a commercial scale (commercial diffusion) of a new or improved product, process, system or service.

Definition of Invention

Invention means any new and useful art, process, machine, manufacture or composition of matter, or any new and useful improvement in any art, process, machine or composition of matter.

PREFACE

This study was prepared for the Ministry of State, Science and Technology under Contract Number 0SR3-0146 between October 26, 1973 and March 31, 1974.

The objectives are:

1. To determine the needs of Canadian individuals and companies for funds for the initiation of technological innovations and their subsequent exploitation.

2. To determine whether these needs are currently being met, and in particular, whether the needs of Canadian-owned companies are being satisfied.

3. To propose means by which these needs might be satisfied more effectively.

As this study will be examined by various interested groups, not all of whom will have the same degree of expertise in each other's fields, explanations in different sections may appear to be redundant to a given expert. The author apologizes for this, but a sincere effort has been made to make each process clear to financial experts, technologists and inventors.

The author wishes to thank all those who so willingly gave their time and opinions, and who graciously answered his innumerable questions — in particular, Peter E. McQuillan, Tax Partner of Ernst & Ernst, Chartered Accountants, who prepared and advised on the various tax questions throughout the study. The inventors who responded with information about their activities deserve special thanks and a strong word of encouragement for their continued efforts to make our country a better place in which to live.

PART ONE

THE AVAILABILITY OF RISK CAPITAL FOR TECHNOLOGICAL INNOVATION AND INVENTION IN CANADA

INTRODUCTION

In order to assess capital availability and accessibility for technological innovation in Canada, it is necessary to examine the whole process from a macro point of view. From this position, it will be seen how the process breaks down naturally into three basic activities, **inventive, entrepreneurial** and **managerial**. Each of these activities is examined in the study.

Commercial diffusion results from the perception of a need and the effective filling of that need with a viable product or service priced at an acceptable level. The filling of the need often is achieved through the development and application of technology. The economic growth of an industrialized country depends heavily on a constant input of new technology. Economic progress is a national goal to which science and technology make important contributions by helping to increase productivity and thereby increase national per capita income. In addition to these common measures of economic progress, other benefits tend to accrue to innovative countries as well, such as an improvement in the general ''quality of life''. On the negative side, growth can also create problems such as pollution and urban decay, so it becomes necessary to support methods to examine non-commercial applications as well, and by doing so we might well provide the solutions for correcting the negative side effects already created.

The Organization for Economic Co-operation and Development (OECD) [1] found that industrial innovation in the Sixties sometimes had harmful social effects, but in spite of this, their Science Policy Committee concluded that even more intensive scientific and technological effort will be required in the future, if economic growth is to be maintained. Assuming our goal is economic growth, and recognizing the need for due consideration of the effect of innovation on the ''quality of life'', it is logical to support and encourage technological innovation in Canada.

THE INNOVATION PROCESS

The following chart was developed to assist in the understanding of the process of innovation, indicating each stage of the evolution from idea to finished product. While the innovation process is viewed as a chain, the need for technological innovation may enter at almost any point in the chain. Often the innovation process begins with this need, perceived by an inventor, but this is not always the case. Sometimes the need for the innovation is first perceived in the marketplace and this perceived need then becomes the stimulative force.

Examination of the overall process of innovation depicted in Chart ''A'' indicates 1) the activity required to advance the process from stage to stage; 2) the need for different talents in each phase, and 3) the need for financing at each succeeding step once past the initial idea stage.

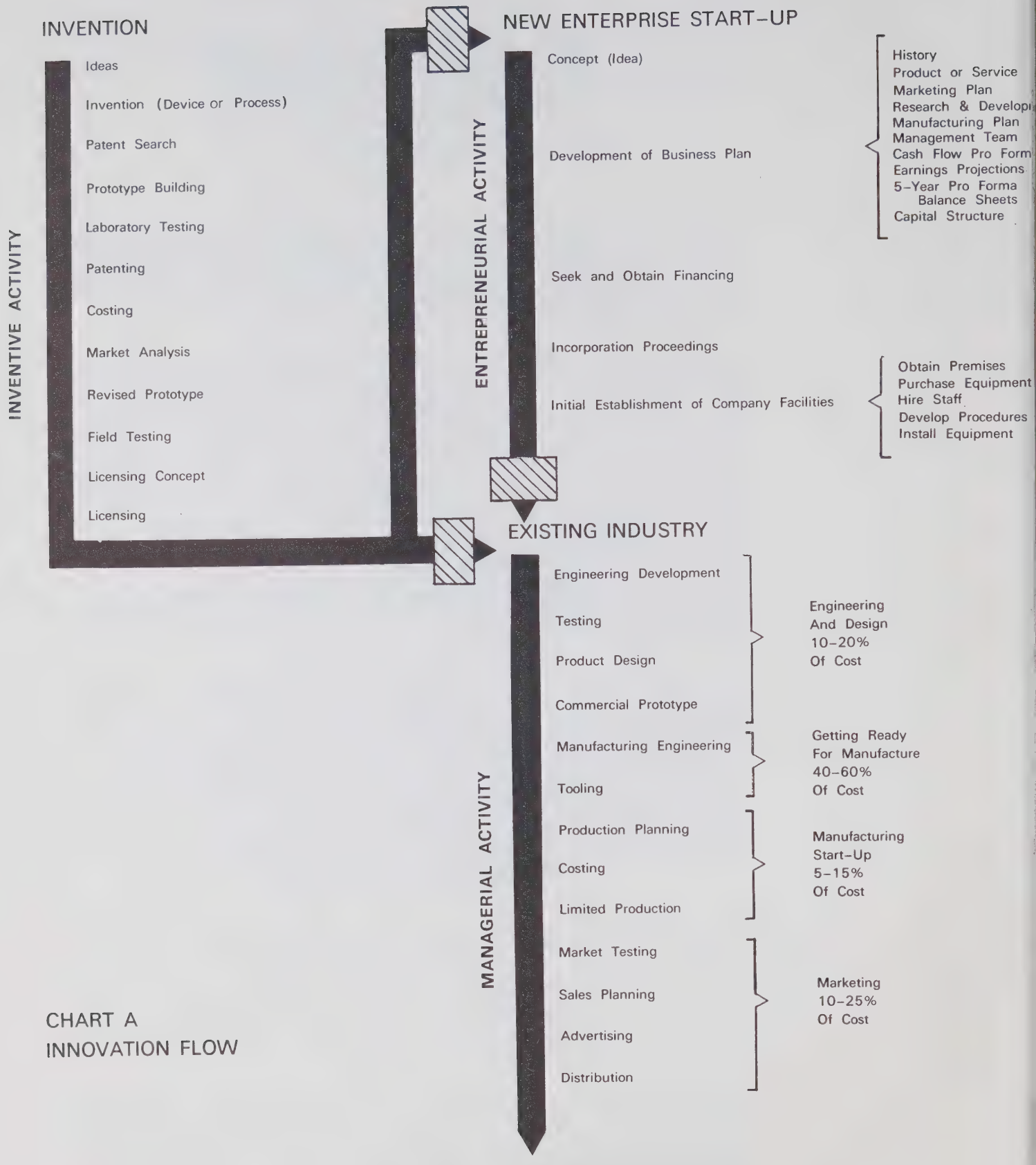


CHART A
INNOVATION FLOW

For purposes of clarity, the column entitled ''Existing Industry'' was placed directly below ''New Enterprise Start-Up''. A new enterprise will go through the same stages as existing industry in addition to the new enterprise stages indicated.

It is important to note the interface (represented by the blocks) between the three **different** activities, **inventive, entrepreneurial** and **managerial.** These interfaces indicate problem areas, as there appears to be a lack of communication and understanding between the groups involved, often resulting in financing and management difficulties at these points. Frequently, an inventor will enter the entrepreneurial arena, without being fully aware of the transition he has made, or the skills the new activity requires. This lack of awareness and inability to provide the skills required may cause the enterprise to end in disaster. Equally, the entrepreneur often must be replaced at a later stage in the company's development if he is unable to successfully meet the company's need for ongoing management skills. Failure to recognize the different skills and talents required to sucessfully fill each role usually ends in disappointment and frustration, both for the individual concerned and his financial backers.

It is rare for an inventor to become a successful entrepreneur and almost as rare for an entrepreneur to become a successful manager. The chances of one man moving through all three phases successfully are remote indeed. Failure to recognize this is to invite potential disaster for the new enterprise and its shareholders.

In order to stimulate indigenous technological innovation flow it is important to 1) screen or vet as many ideas as possible; 2) guide creative (inventive) people towards producing useful ideas; 3) encourage the creation of as many inventions as possible from good ideas; 4) bring good inventions to a stage where they can be licensed, 5) expose every good licensable invention to existing industry, and/or entrepreneurs.

It is equally important to create a climate to encourage the flow of high-risk capital to finance new enterprise start-ups and provide development capital for young firms.

Failure to support any stage of the Canadian innovative chain will restrict the flow, causing an even greater underutilization of our creative potential.

INHIBITING FACTORS TO COMMERCIAL DIFFUSION

> *''No amount of scientific excellence or increased expenditure for research and development will improve economic performance if management is unskilled in its tasks... They must assume risks along with creative imagination, entrepreneurial drive, and organizational skills of a high order... No task may be more important for improving Canada's innovative performance than to strengthen the capabilities of Canadian management to understand and manage technological changes and the innovative process... Innovation should be given much more attention in Canada. It is the bridge which spans the valley between knowledge and economic performance and this is a bridge which must become increasingly strong if Canada is to achieve and maintain high standards of economic performance in today's rapidly changing world.''* [2]

Aside from intent and will, probably the greatest single inhibiting factor to the process of innovation leading to commercial diffusion is risk-aversion.

Evidence of risk-aversion is prevalent in all levels of government, industry and finance, but is most prominent in large companies. Established commercial enterprises which have captured a major segment of the marketplace, almost always display the greatest conservatism towards innovative concepts, especially radical ideas. In many respects this is to be expected, as the large, well-established company has the most to lose. (Remember the Edsel?) But equally they are in the best position to innovate technologically because of their facilities and assets. Unfortunately, unless there is a single driving force at the helm of the large company, this seldom happens.

If an established firm is profitable, managers tend to ''stick with what they know'' rather than venture into new and untried fields, with the accompanying risk of a substantial loss, unless they feel threatened by some new technological development. Threat usually arises from a small aggressive firm, established by entrepreneurs, that has no market to lose. Realistically, we should not expect to find strong innovative attitudes in most professional managers, as this trait has been found to be contrary to their basic personality patterns, but we should anticipate this quality in entrepreneurs. Indeed, willingness to innovate appears to be a common quality in most entrepreneurs. The Organization for Economic Development and Co-operation (OECD) [3] found that small firms often made major innovations, whereas large firms seemed unable to evaluate radical proposals or were unwilling to assume the risks required to bring the innovation to fruition.

Innovation is a risky business, but a winning combination can produce major benefits, not only in terms of profit, but in extending the life cycle of a company as well. Every so often technological innovation will provide the foundation for a new industry, with the innovating company becoming the leader in the field. Failure to innovate may cause a company to continue on the downswing of its life cycle to the point where it becomes a takeover candidate or even dies.

CAPITAL MARKETS IN CANADA

Access to capital markets is not normally a problem for large corporations even in periods of economic decline, depressed stock markets or periods of monetary restraint. Large established corporations have capital raising roads open to them, such as short-term borrowings, bond issues and convertible debt, that are largely unavailable to the small company.

The Canadian capital market has significantly increased in depth in recent years and appears able to absorb new issues without difficulty from large, profitable corporations. It has been estimated that the total annual demand in the next five years for additional equities in Canada is likely to be almost double the supply made available through net new Canadian issues. Studies indicate there will be an annual demand of $1.3 billion for equities versus an estimated domestic supply of only $0.7 billion. [4] This increased demand appears to arise essentially from institutions, who are traditionally conservative investors. Higher-risk Canadian issues, such as junior industrials, over-the-counter stocks and especially concept underwritings, have had a difficult time since 1969/70. During this period, it has been almost impossible for young companies to obtain a public underwriting, leading one to conclude the equity demand is primarily for seasoned, conservative issues. Even if the Canadian underwriting community brought higher-risk issues to market, it is likely the demand for equities would be satisfied by the purchase of conservative U.S. issues, rather than by the purchase of high-risk Canadian issues.

This is related to our unique foreign ownership problem, as a large number of seasoned senior firms operating in Canada have not made any equity available to the Canadian investing public, for example, General Motors. Large portfolio managers are often forced to acquire shares of parent companies outside of Canada to obtain diversification in certain industries, as they are simply not available here. It therefore is not sufficient to estimate ''equity'' demand, but it is important to establish the levels of risk that investors are willing to assume when making an investment.

During periods of market decline, investors tend to stay with the established ''known'' and underwriters in turn heed that message, refusing opportunities to bring new issues to the market on the ground that the issue may not sell. The innovation process tends to slow down during these cycles, due to the shortage of higher-risk funds available. Corporate retained earnings are sometimes used during these periods, as greater values can then be obtained, but usually for internal expansion or acquisition rather than riskier innovation.

Some large companies maintain an aggressive posture as a basic policy or attitude. They are generally considered to be ''growth'' companies, but it should be remembered their **prime** aim is to increase earnings to attract a higher price/earning ratio for their shares, not necessarily to grow by innovation. In this case, much of the growth is achieved by acquisition of smaller innovative companies. A few ''super growth'' companies are innovative and aggressive (for example, Xerox, Polaroid, IBM, RCA) and this outlook is reflected by the very high P/E ratios normally enjoyed by their shares.

A high P/E ratio assigned to its shares by the public will allow an acquiring company to take over another company at a relatively low cost, by issuing treasury shares in a share exchange deal. This is especially advantageous if the company being acquired suffers from a low P/E share evaluation, or if its shares are not publicly quoted. The acquiring company reduces its risk exposure by buying technology which has been developed and proven and is now ready for market exploitation.

Most large, well-established companies are not innovative by nature and normally only become so when they perceive their position to be threatened. Growth companies are aggressive but not necessarily innovative, seeking growth by acquisition of existing earnings or technology.

While availability of capital does not appear to be an inhibiting factor for large Canadian corporations, the total capital pool available for equity investment in Canada has a decided impact on the overall direction and thrust of our economic growth. If, for example, investor attitude shifts to the right or the conservative side of the spectrum, it tends to leave a vacuum in the higher-risk area to the left or innovative side. Such a shift tends to inhibit innovative activity which may then require some other form of stimulus to activate the process.

Canadian capital requirements and our ability to meet them internally have been debated for years. One of the best analyses of the question was put forward in the Gray Report [5] in which it was stated:

> *''The adequacy of the level of savings in Canada must be measured against the nation's requirements for capital. The extent to which domestic savings fall short of, or exceed those requirements is reflected by the state of the current account of the balance of payments. A current account deficit indicates the*

amount by which domestic savings fall short of meeting the nation's requirements for capital and hence its need to look to foreign sources to make up the difference. The converse holds true in the case of a current account surplus. The extent to which the nation must rely on foreign savings to meet its requirements for capital plays an important part in determining the degree of control Canada can exercise over its own economic environment.''

SUMMARY OF THE CANADIAN BALANCE OF INTERNATIONAL PAYMENTS 1960–1973*

(Millions of Dollars)

	Total Current Account Balance
1960	– 1,233
1961	– 928
1962	– 830
1963	– 521
1964	– 424
1965	– 1,130
1966	– 1,162
1967	– 499
1968	– 107
1969	– 952
1970	+ 1,060
1971	+ 306
1972	– 623
1973	– 425

*Source — Statistics Canada.

In their first of a series of studies for the Toronto Stock Exchange examining Canada's capital markets, Professors David Shaw and T. Ross Archibald [6] provide statistical documentation of Canada's sources of capital funds since the end of the Second World War. In 1950, domestic savings accounted for 92% of the total capital expenditures while foreign sources financed only about 8%. At that time, gross domestic savings equalled 20% of the GNP. By 1960, domestic sources declined and provided only 83% of capital formation. Similarly, the rate of domestic savings in 1960 had fallen to 16% of the GNP. By 1970, Canadian domestic savings amounted to about 23% of the GNP and exceeded domestic capital formation so that Canada became a net exporter of $1.1 billion. Consequently, Shaw and Archibald concluded that:

> *''Canada's historical international position as an importer of funds (had) changed and this country (could now) generate sufficient savings to finance the current level of capital investment.''*

Since their study was completed, the capital position has again changed, with deficits in 1972 and 1973, with an even larger deficit anticipated for the first quarter of 1974. There is a good deal of controversy surrounding this question. As it now

appears we will require substantial new capital expenditures for major resource developments over the next decade, we undoubtedly will be net importers of capital for some time to come. It is important to stress however, that the **form** of capital importation is significant to the economic development of Canada. Whenever it is feasible, capital importation should be via borrowings and equity sales to foreigners should be discouraged. A policy of this type should reduce debt offerings in Canada, thereby in theory freeing more funds for equity investment and improving ownership domestically.

Aside from domestic capital availability, the most important question seems to be, ''How do we put our investment capital to work?''

Traditionally, Canadians keep the majority of their funds in some form of debt vehicle: bank accounts, certificates of deposit, trust certificates, mortgages, bonds, etc. When we invest in equities, it is usually in large, well-established companies. Further, a significant portion of our capital pool is administered for us by institutions such as banks, life insurance companies, trust companies, mutual funds, closed-end investment trusts, and REITS (real estate investment trusts) and the percentage is increasing, encouraged by favourable tax incentives such as RRSP's (registered retirement savings plans). The very nature of the pension vehicle causes most institutions to maintain a conservative investment attitude in the administration of these funds. Institutions managing other funds tend to be conservative as well, for reasons which will be discussed later.

ASSETS UNDER ADMINISTRATION IN CANADIAN CORPORATE AND TRUSTEE PENSION FUNDS*
(Billions of Dollars — Dec. 1972)

Private	$ 7.4
Federal	1.4
Provincial	1.3
Municipal	1.6
Educational Institutions	1.9
Other	.5
TOTAL	$14.1

*Source: The Bank of Canada Annual Review, Jan. 1974

> *''Canadians have always been savers and have one of the highest ratios of savings to personal disposable income in the world. A great part of these savings are in bank deposits, pensions, and life insurance. By 1969 we had almost as much life insurance in force ($94.0 billion) as the entire population of the United States ($159.0 billion)''.* [7]

To give some indication of what this penchant for institutional savings means in capital amounts the following **reserve** figures are quoted:

REQUIRED RESERVES FOR LIFE INSURANCE COMPANIES, INVESTMENT COMPANIES AND TRUST & LOAN COMPANIES
(Billions of Dollars — Dec. 1972)

Life Insurance Companies (a)		
Canadian	$13.3	
British	1.2	
Other foreign	2.3	
TOTAL LIFE COMPANIES		$16.8
Investment companies		7.0
TOTAL		$23.8
Ontario Registered Trust & Loan Companies (b)		
Trust Companies	$1.2	
Loan Companies	.4	
TOTAL ONTARIO TRUST & LOAN COMPANIES		1.6
TOTAL		$25.4

Sources: (a) Annual Report of the Superintendent of Insurance for Canada, Vol.1, Dec. 1972; (b) Annual Report of Registered Trust and Loan Companies in Ontario, Nov. 1972.

It should be noted these figures are not total assets, but only their legally required reserves. Trust and Loan figures for provinces other than Ontario were not available, but, if they were added the above total of $25.4 billion would be even higher.

PERSONAL SAVINGS ACCOUNTS IN CANADIAN CURRENCY*
(Billions of Dollars — April 30, 1973)

1968 —	$12.6
1969 —	14.4
1970 —	15.8
1971 —	17.5
1972 —	19.1
1973 —	21.3

*Source: Chartered Banks of Canada Fact Book, 1973

The Globe and Mail reported in February, 1974 that $24.4 billion was currently on deposit in savings accounts in Canadian chartered banks — a figure that has grown consistently over the years.

As this is ''demand'' money, effectively ''on loan'', banks must keep a large portion of deposits in a highly liquid form in order to meet withdrawal demands at any time. That requirement prevents bankers from lending for long periods and/or assuming a high degree of risk, and virtually eliminates the possibility of investing depositor's funds in any form of equity. This does not preclude the banks from investing a portion of their own funds in higher-risk investments. Indeed, several chartered banks are shareholders in formal venture capital firms, but greater incentive could be provided to encourage all banks to direct more funds to this area.

Canadians are risk-averters, or more accurately, the Canadian environment makes it more acceptable to be risk-averse, as indicated by our predeliction for debt securities. To a large extent, we can trace our difficulties with foreign ownership to risk-aversion and our resulting preference for debt securities, coupled with a desire to enjoy a high living standard. When the Canadian industrial economy was emerging, instead of borrowing funds externally as the Americans did and retaining equity control, we did the reverse, allowing others to assume the risk of ownership, and, in many cases, **loaned** them the funds to exploit our own opportunities! In this manner, we have largely financed our own takeover. While much has been said on this subject, and the dialogue has by no means ended, it appears that one of the major underlying causes of the foreign ownership problem is risk-aversion on the part of our investing public and financial institutions.

If we are to cause more funds to be available for innovative activity, we must work towards directing Canadian capital to equity investment and away from debt. The Canadian preference for "safe" debt investments is one of the major inhibiting factors in the stimulation of economic growth through innovation.

If, somehow, we can make Canadians conscious of the value and power of equity vs. debt, we will have made a significant contribution towards resolving our capital environment problem. The financial system as a whole is affected by this inherently Canadian attitude, but the most serious impact is on innovative activity that requires venturesome financial backing.

The present government appears to support the formation and development of Canadian firms as an offset to foreign ownership. That thrust, coupled with the opportunity presented by an adequate energy supply at a price lower than the rest of the industrialized world — which in turn should reduce the cost of raw materials for secondary industry — has created a favourable climate and unprecedented opportunity for Canadian entrepreneurial activity. The question is — will it be Canadian-owned activity?

If Canada acts quickly and resolutely it can take full advantage of the current world economic situation, by developing policies and programmes to support the formation and growth of new Canadian-owned enterprises.

As previously stated, findings indicate that capital availability for the large, well-established firm is not a cause for concern. However, considerable concern for the smaller firm is warranted, especially for the small technologically innovative firm.

The Science Council of Canada [8] concluded:

> *"Generally, while certain governmental measures have served to improve the climate for investment in Canada, the climate is still inhospitable. There remains, too, an air of uncertainty about future government actions and about shifting emphasis in our industrial policy. The net effect is to discourage the imaginative and aggressive use of the investment funds available from both domestic and foreign sources.*
>
> *These difficulties apply particularly to small companies, no matter how great their potential. Both federal and provincial governments should explore the possibility of creating new mechanisms for supplying capital to new and small companies. It may also be necessary to help underwrite their management and training costs.*

In the last resort, it may be necessary to insure the loans made by private venture capital firms."

The Science Council recommended that direct government intervention be kept at a minimum, suggesting that the government try to improve the investment climate by removing barriers to high risk investment for financial institutions.

This is a commendable aim, which could be achieved by creating a tax climate that encourages the individual as well as the institutional investor to invest in new and small Canadian firms, especially those based on technology that shows distinct promise in domestic and export markets.

THE CANADIAN INCOME TAX STRUCTURE

Much has been said and written about the new Canadian Income Tax Act, a good deal of which has been critical, predicting chaos in its application. Contrary to expectations, the transition has been unexpectedly smooth, largely due to the Department of National Revenue and the Department of Finance's willingness to listen and amend, plus explanations issued through information bulletins, technical interpretations, advance rulings and instructive booklets.

In spite of these efforts, most businessmen still find taxation to be a complex and sometimes mysterious subject. In an effort to clarify some facets of the tax effect on technological innovation, the following points are highlighted.

TAX INCENTIVES

Managerial Activity

1) Canadian manufacturing and processing profits have been taxed at a preferentially low rate (40% as compared to approximately 48% previously) since January 1, 1973. This is about 20% lower than the old rate or the level of tax for other corporate activities at present.

   The end result of this incentive is higher (after-tax) earnings. The extra profit may be used to expand operations or reduce prices of finished goods, creating a better competitive position for export. Its use of course is up to management, but at least they have the option to expand, innovate, reduce prices or enhance the return on their shareholders' investment.

2) The rapid write-off of capital expenditures on fixed assets used in the manufacturing or processing of goods for sale over as little as two years, can be a strong incentive for improving the company's manufacturing capability or introducing process innovations. CCA (Capital Cost Allowance) is an important ingredient in analysing a new project, as it will have a direct bearing on the project's net present value and projected return on investment. Often, management's decision on whether or not to proceed with a new project will be determined by the analysis referred to above, so the CCA could be a deciding factor.

3) Scientific research and capital expenditure related to this activity is fully deductible in the current taxation year. This does not appear to be overly encouraging (R & D expenditures were at one time deductible at a rate of 150%) but the Tax Department apparently takes a fairly generous view of what

constitutes scientific research. In addition, the Industrial Research and Development Incentive Act (IRDIA) has been introduced to provide research grants to industry on a project basis, whether the Company is profitable or not, replacing the previous tax incentive.

Entrepreneurial Activity

1) Canadian-controlled private corporations are entitled to the small business deduction on the first $50,000 of income derived from active Canadian business sources. They may continue to do so until a cumulative total of $400,000 has been reached. This reduced tax rate helps small new companies in their early stages and provides a modest incentive to the entrepreneur.*

2) Taxpayers receiving advance payments on account of services not rendered or goods not delivered before the end of a fiscal year are permitted generous reserves for unearned income. These advances are equivalent to tax-free financing and could be helpful under certain circumstances.

3) Corporations are still permitted to accrue and deduct employee salaries or bonuses that will not be actually paid until the following tax year. This could help a cash-short company in compensating key employees or even attracting them to a new enterprise.

Inventive Activity

No tax incentives are apparent for this activity where the private or individual inventor is concerned.

TAX DISINCENTIVES

The new Income Tax Act is far from a one-way street, as there are many disincentives present in the new system and some of these may have a serious long-term adverse effect on technological innovation in Canada.

1) The introduction of a tax on realized capital gains is a decided liability from the investor's point of view, especially for high-risk investments. As pointed out elsewhere, the risk/reward ratio must make sense to attract this type of capital and the transfer of part of the ''reward'' to the government in the form of tax makes it even more difficult to balance the equation. It also has the long-term effect of reducing the amount of capital available for all types of private investment, as a portion of all capital upon realization is skimmed off for tax, forever lost for private investment purposes in the hands of the individual investor.

2) The special tax treatment of stock option plans as a remuneration device will be discouraged in the future. This has special implications for the entrepreneur, as the stock option plan has traditionally formed a significant portion of the compensation package in start-ups and other ventures. It is an especially useful device when attempting to attract senior specialists to a new or small company, without involving cash outlays on the part of the company. Stock options will now be treated essentially as ordinary income to employees, but are not a deductible expense to the corporation, even though it represents a real cost to the company and its shareholders.

3) The limit of five years in carry-forward of non-capital losses seems unnecessarily restrictive. Often a new company does not even reach a break-even point until it has been in operation for many years and has little chance to use its

*Since this study was completed, the allowances have been increased to $100,000 and $500,000 respectively.

full carry-forward tax loss within the five-year limitation. This is another inhibiting factor to be considered by high-risk investors, reducing the potential return or even possibly affecting the survival of a small new company.

4) Only one-half of certain intangibles may be amortized for tax purposes. For example, the capital cost of purchasing a license with an unlimited life would fall into this category. This could affect technology transfer, which is important to Canada's technological development.

5) Compensation to wives is not deductible in partnerships and proprietorships. At times, this may be grossly unfair, especially when a small business is being started with limited capital.

6) Partnership provisions in the Act appear to be incredibly complex, acting as a deterrent when considering the formation of an enterprise in this form.

7) Little provision is made for individual inventors to deduct costs of invention, including patents, from their ordinary income. This often creates undue hardship for a group that is normally struggling anyway.

8) Recognized venture capital companies, in the eyes of the tax authorities, may yet be held to be in the business of making venture investments. If this position is upheld, realized capital gains would be deemed to be ordinary income and taxed accordingly. This could reduce their return so severely, the venture capital industry in Canada might disappear completely.

While the new Income Tax Act offers some incentives to the formation and growth of business, it clearly could be improved. Most of these incentives become meaningful only when a company begins to show a profit, and technological innovation, especially radical innovation, usually takes many years to produce a profit.

A stimulating catalyst is needed, considering the present and historic Canadian financing environment of risk-averse individual investors and institutions with a penchant for fixed and predictable income, who are reluctant to support start-ups. The Income Tax Act could be used to provide this stimulus.

THE UNDERWRITING COMMUNITY

The underwriting community has been reluctant to entertain many new issues for unseasoned firms since 1969. This is a reflection of general market conditions and investor attitude, but that is small consolation to the young firm that requires funds for development and expansion or, for that matter, working capital.

GROSS NEW ISSUES BY CANADIAN CORPORATIONS*
(Millions of Dollars)

Year	Common	Preferred	Total
1969	595	103	698
1970	94	127	221
1971	96	128	224
1972	381	225	606
1973	388	119	457

(These figures do not include debt securities, warrants, rights or conversions or any floor distributions under $500,000.)

*Source: Wood Gundy Limited.

The importance of adequate equity financing mechanisms can be illustrated by examining the debt and equity capital requirements of a young, developing company and how these equity needs are currently satisfied. (Equity is represented by common and preferred shares, while debt may take many forms such as bonds, debentures, mortgages, shareholder loans and bank loans. Current debt is that which is due in less than one year, with long-term debt making up the remainder).

What is considered a satisfactory debt/equity ratio varies radically from industry to industry, depending a great deal on profitability and anticipated stability of earnings. While almost all business will benefit from some leverage (borrowing to increase profit by using a larger amount of capital), too much debt can be a severe liability, possibly even leading to the demise of the company. Many small companies carry too much debt. Excessive debt servicing costs can seriously retard corporate growth as it reduces the company's ability to build up retained earnings, which forms the base of most future expansion. If a company does not internally generate sufficient funds for expansion, it must either sell off treasury shares (if it can) to give it a larger equity base, or increase its debt load and start the whole cycle over again.

The offering of treasury shares to the public is a chancy thing at best, subject to the mood of the underwriting community and whims of the investing public. The current state of health of the stock market normally has no bearing on the need for expansion or development funds for an individual company, but if they cannot raise equity money from that source, where else can they turn?

Private placement of treasury shares is sometimes accomplished through investment dealers, but not as readily in Canada as in the U.S. There, investment banks usually handle private placements, while in the U.K. merchant banks primarily act as the intermediary. These shares are normally sold to financial institutions, often at a significant price advantage to the buyer, but the number of institutions in Canada willing to make private purchases of stock in small Canadian companies is substantially lower than in the U.S. Comment has been made about the conservative outlook of financial institutions, but one must remember that they are also affected by current stock market conditions, both as to availability of cash and willingness to invest, similar to the private investor.

The routes open to young companies seeking equity funds are few, and at times, virtually non-existent. Under the market conditions that have existed for nearly five years now, or if their requirements are such that underwriters consider the offering to be too small and hence not profitable enough for their efforts, the small company often gives up the idea of obtaining equity at a reasonable price and resorts to

borrowing in spite of the problems added debt may create. If their credit rating is not excellent (as is almost always the case), they must pay a high, and sometimes, exorbitant interest rate, frequently with very difficult terms.

THE BANKING INDUSTRY

Aside from the fact that current bank indebtedness must rank ahead of all other corporate debt, the main difficulty with bank loans is the short time or term they span. Normally, banks will not issue term notes for more than three years, occasionally extending this to five years, but they prefer to limit loans to one or two years. Also, banks like to lend on assets, preferably liquid assets, which often rules out bank loans for young growing companies.

The branch system, which is so extensive in Canada, is part of the lending problem. Loans of any significant size must be approved by authorities above the local manager, yet all loan requests must arise through him, removing most of the personal elements from the deal. Regional banks in the U.S. are often locally owned, sometimes by the chief executive who lives and works in the same community, providing an opportunity to develop some personal rapport for a small local company. American banks are limited to operating in one state only, and in some states, are allowed only one branch. This means that support of local industry is mandatory if the banks are to grow, resulting in a much greater availability of funds to smaller companies.

Most American bankers are probably not much more risk-prone than their Canadian counterparts, but the domestic American banking system tends to force them into a more aggressive mode.

The movement towards regional autonomy with larger loan authority recently announced by some Canadian chartered banks is to be commended. The growth in Canada's newest chartered banks, Unity Bank of Canada and the Bank of British Columbia, is interesting, considering their regional posture, which is due to policy in the case of the former and the location of the latter. It will be some time, however, before they can make much of an impact, as the five largest chartered banks control approximately 92% of all the Canadian banking industry's assets!

INDUSTRIAL DEVELOPMENT BANK

The IDB (or the proposed new Federal Business Development Bank) was formed to answer the very need described above, to provide term loans of five to ten-year duration, especially to small businesses. While the IDB is empowered by its charter to purchase equity in Canadian firms, it has not chosen in the past to utilize this mandate to any meaningful degree.

Under the proposed revised programme and format for the IDB, the Federal Business Development Bank (FBDB) has been directed to provide equity funds "where it is deemed to be advisable". This is a large step forward, **if** the senior management of the Bank is able and willing to execute this concept. One must remember they have been term lenders for 29 years–basically a banking function. Now they are being asked to become effectively venture capitalists, a role quite foreign to bankers and one that requires a completely altered outlook and attitude, not to mention expertise. If the FBDB's equity function is to be successful, a very strong lead in this direction

must come from the Board and senior Bank executives. The chief executive should have a clear grasp of the problems and advantages of equity investment, in order to direct the efforts of the other officers and staff.

The IDB, or the proposed Federal Business Development Bank should retain consultants to develop a programme of instruction for its senior managers and staff in the area of equities, as bankers cannot realistically be expected to have any degree of expertise in this type of investment.

It would also be advisable, when selecting new Directors for the FBDB, to seek men with experience in the equity sector. If the Bank is able to develop a viable policy and an efficient mechanism for the execution of the new policy, the Bank's entry into the equity field in Canada could have an enormous impact on the venture capital industry. But a great deal more effort and resolution will be required in the equity area than the Bank has shown in the past, if this policy is to succeed.

THE VENTURE CAPITAL INDUSTRY

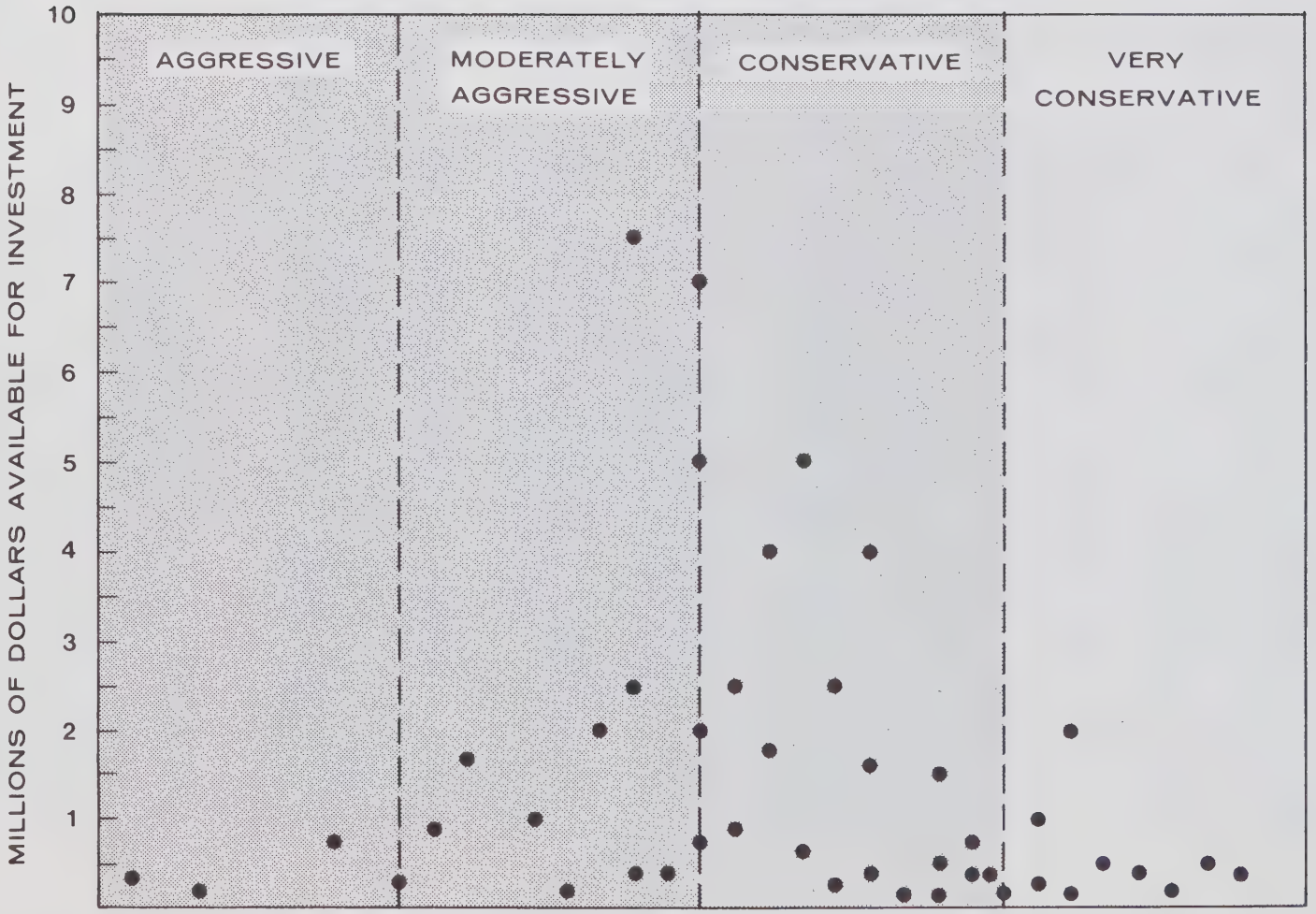
The logical place for a young, expanding company to seek funds is from the venture capital industry. Before examining this group's activities, some clarification of the role played by these interested investment companies is in order. Venture capital is not a special or peculiar type of capital. Its availability is dependent on the general economic risk and return potential of other types of investments, the general economic situation, and the subjective perceptions of various kinds of investors and their particular definitions of risk. The objective of the venture capital investor is higher than average return for the lowest possible risk, not necessarily venture capital investment **per se.**

Formalized venture capital firms are those companies with paid-in capital earmarked for the purpose of achieving the highest possible growth rate in the shortest possible time with **the least possible risk exposure.**

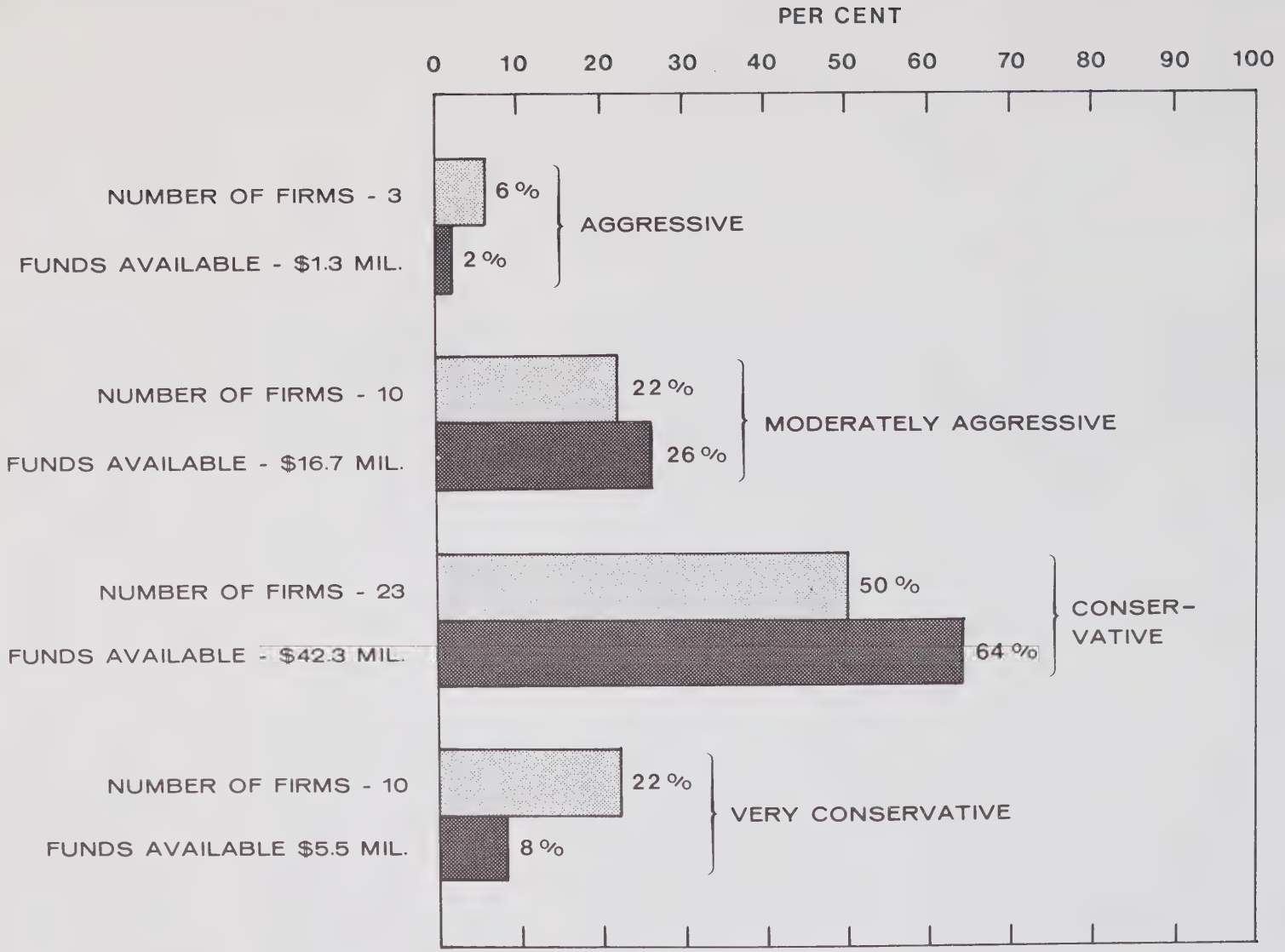
This lays the ground work for a greater understanding of the wide disparity of investment outlook and degree of risk-taking found in venture capitalists. The industry in Canada covers the full scale of the spectrum as might be expected, with the largest concentration in the ''right-of-centre'' area.

It is almost impossible to be definitive about the attitude of any given venture firm toward risk, as their tendency when questioned is to answer ''show me the deal, and I'll tell you if we'll invest''. However, one can make a subjective estimate by past investments, current attitude and expressed outlook. To illustrate the general spread of the Canadian venture capital industry, charts 'B' and 'C' were developed, based on the authors' observations, interviews and venture capitalists' statements and investment records.

CHART B



SUBJECTIVE CLASSIFICATION OF VENTURE CAPITAL FIRMS IN CANADA BY CATEGORY



SUBJECTIVE CLASSIFICATION OF VENTURE CAPITAL FIRMS IN CANADA

CHART C

There is a severe shortage of aggressive venture capital investment firms in Canada and they currently control only an estimated two per cent of the funds reported available for investment.

Most firms fall into the "conservative" sector of the spectrum rather than the "aggressive" or "venturesome" side. Chart "C" gives a percentage breakdown of reporting firms by funds available for investment and category assignment within the industry. One must bear in mind the terms used are relative and so are the positions estimated, but it illustrates the dearth of high-risk money available in the venture capital industry.

Venture capital activity may be divided into five categories:

1) Start–up
2) Development
3) Expansion
4) Turnaround
5) Buyout

Broadly, these activities may be classified as to degree of risk involved as follows:

1)	Start–up	— high risk
2)	Development	— medium risk
3)	Expansion	— modest risk
4)	Turnaround	— modest risk
5)	Buyout	— low risk

Broad categorization such as this can be dangerous as the degree of risk varies greatly with the individual situation. A poorly researched buyout could be very risky, whereas a well developed and thoroughly analysed start-up may be relatively safe.

Venture capitalists receive more proposals for start-ups than any other activity, as most people believe this to be their main interest. In spite of this, start-ups represent a small portion of their investment in dollars, but require a substantial amount of their time. Expert opinion in the U.S. estimates about 6% of venture funds are allocated to start-up activities (this does not include Small Business Investment Corporations — SBIC's). The Canadian industry estimates about 5% of available funds currently support start-ups.

Les Crane [9] found a higher percentage in an earlier study. Thirty-one firms reported they invested a mean average $345,000 in 24 start-ups from June 1969 to June 1971, representing about 34% of their total estimated investments. Industry opinion indicates the average Canadian start-up today requires at least $150,000 initial investment with a much higher total investment required for subsequent phases of the start-up process. A much lower percentage of funds available is going into start-ups today (estimated 5% vs. the 34% in 1971). This may be a reflection of market conditions over the past few years plus an increasingly conservative attitude on the part of the venture capitalists as they become older, more mature and experienced, and possibly, as some venture capitalists have suggested, disillusioned.

Returning to the hypothetical case of the expanding young company, which is clearly a category three or expansion candidate, the Company logically should approach one or more venture capitalists for funds, assuming they are able to identify a firm or firms to contact. The very low profile maintained by most firms in the venture business has been a great roadblock. Fortunately, a recent publication put out by the Department of Industry, Trade and Commerce entitled "Sources of

Venture Capital — A Canadian Guide'' will partially alleviate this situation, if it is kept current, widely distributed and read.

Even if they locate one or more venture capitalists, unless the entrepreneurs have prepared a reasonably detailed analysis of their situation and future outlook, they probably will not get beyond the initial discussion stage. It is estimated that up to 90% of all requests made to venture capital firms do not get past the first interview stage and that, eventually, only 1% of all proposals are actually funded today.[10] Elkin and Miller [11] reported that in 1970, ten Canadian venture firms had received 1,520 requests in the previous two years, 250 (16%) were investigated and 52 (3.4%) were funded. Today, the venture capital firms are even more selective.

When a venture capitalist considers a proposal, he must determine how he will eventually realize on his investment. Traditionally, ''going public'', or offering the young company's shares through the underwriting community for sale to the public, has provided the most likely ''exit''. Unfortunately, the erratic and unsettled condition of the stock market over the past five years has virtually eliminated this route, adding another element of risk to investments in private company shares. Alternatively, the company may be sold to a larger company, but this market has been potentially reduced by the introduction of the Foreign Takeover Review Agency. These factors have tended to make venture capitalists more cautious, especially when considering start-ups.

Russel Knight and Dale Oliver [12] in June 1971 identified 44 firms engaged in venture capital activities (Table I). Of these companies, only 12 were established prior to 1968 so the remaining 32 are now less than six years old. Even so, a number today (March 1974) are no longer active in the field, and reported ''funds available for investment'' have declined substantially, which became apparent when the author resurveyed the original 44 firms. Some new firms have since entered the field and a number of firms, not identified in the 1971 study, were contacted (Table II) adding 35 firms for a total of 79 firms, of which 77 were surveyed.

TABLE 1

FUNDS AVAILABLE FOR VENTURE CAPITAL INVESTMENT

FIRMS SURVEYED BY KNIGHT & OLIVER IN 1971 AND RESURVEYED BY GRASLEY 1974

Reporting Company	Year Founded	June 1971 $	Feb. 1974 $	Current Status
1	1971	Unlimited	0	Cannot locate.
2	1969	N/A	0	Out of business.
3	1968	7,000,000	200,000	Virtually retired from field.
4	1969	3,000,000	500,000	Semi-Active.
5	1953	N/A	0	In merchant banking.
6	1952	18,000,000	0	Acquired by another company
7	1970	500,000	0	Fully invested.
8	1963	N/A	0	Fully invested.
9	1968	Unlimited	1,000,000*	Active—no start-ups.
10	1970	1,000,000	300,000	Active.
11	1969	Fully invested	0	Fully invested.
12	1969	1,000,000	0	Out of field.
13	1970	N/A	0	Out of business.
14	1971	N/A	0	Fully invested.
15	1962	Unlimited	Much reduced	Stockbroker.
16	1968	N/A	2,500,000*	Selective in natural resources.
17	1959	N/A	1,750,000*	Active.
18	1953	13,000,000	1,000,000	Active.
19	1969	2,600,000	500,000	Not investing in Canada.
20	1962	Unlimited	4,000,000	Active.
21	1969	2,450,000	0	Out of field.
22	1970	N/A	0	Out of field.
23	—	N/A	N/A	Active—private.
24	1970	N/A	N/A	Active—private.
25	1968	N/A	0	Now in merchant banking.
26	1968	N/A	1,500,000*	Semi-active—no start-ups.
27	—	N/A	300,000*	Semi-active—early financing.
28	1967	260,000	800,000	Active*.
29	1967	N/A	75,000*	Semi-active.
30	1969	3,500,000	0	Investing only in the U.S.A.
31	1956	3,500,000	0	Out of field.

Reporting Company	Year Founded	June 1971 $	Feb. 1974 $	Current Status
32	1969	N/A	0	Cannot locate.
33	1969	5,000,000	0	Out of field.
34	1965	N/A	0	Active—in packaging.**
35	1960	1,100,000	0	Out of field.
36	1966	N/A	0	Out of field.
37	1970	2,000,000	0	Acquired by another company.
38	1970	N/A	0	Active—in packaging.**
39	1969	N/A	0	Started new company.
40	1969	N/A	0	Out of field.
41	1965	Unlimited	Unlimited	Pension fund.
42	1969	62,000	0	Out of business.
43	1969	70,000	50,000	Semi-active.
44	1970	Unlimited	Unlimited	Pension fund.
Total reported (17 Firms)		64,042,000	3,350,000	
			11,125,000	
			14,475,000	

(*) Total for firms not reporting any amounts in 1971 but did report in 1974

(**) "Packaging" — acting as an intermediary between the firm requiring capital and the sources of capital. The "packaging" activity may include assistance in preparing borrowers' plans, pro forma balance sheets, cash flows, etc., but does not include any large investment on the part of the packager.

NOTE: Only 17 firms gave a specific answer in Knight & Oliver study to the question "How much capital do you currently have available for investment?" Those firms are identified by the shadow line linking their answer to the same question in February 1974. For purposes of comparison the 1974 and 1971 totals for the 17 firms are given separately.

TABLE II

FUNDS AVAILABLE FOR VENTURE CAPITAL INVESTMENT

ADDITIONAL FIRMS SURVEYED IN 1974

Reporting Co.	Year Founded	Feb. 1974 $	Status
1	1965	500,000	Control only—no start-ups.
2	1968	700,000	Active.
3	1970	7,500,000	Active.
4	1972	250,000	Active—wants to control board.
5	1972	400,000	Active.
6	1973	2,500,000	Active—resource oriented.
7	1968	600,000	Active.
8	1970	750,000	Active.
9	1966	0	Active—supports invention.
10	1971	200,000	Active—no start-ups.
11	—	500,000	Active—no start-ups.
12	1971	2,000,000	Active.
13	1972	400,000	Active.
14	1971	750,000	Semi-active—no start-ups.
15	1972	250,000	Active—no start-ups.
16	1962	2,000,000	Conservative—stockbroker.
17	1972	0	Merchant banker.
18	1968	200,000	Active.
19	1972	50,000	Packagers.
20	1972	5,000,000	Active—conservative.
21	1969	1,600,000	Active—no start-ups.
22	1968	2,000,000	Active—stockbroker.
23	1950	0	Not investing in Canada.

Reporting Co.	Year Founded	Feb. 1974 $	Status
24	1972	250,000	Active—conservative.
25	1970	0	U.S. only.
26	1961	750,000	Active—conservative.
27	1972	4,000,000	Active—no start-ups.
28	1972	1,800,000	Active—no start-ups.
29	1969	400,000	Active—conservative.
30	1942	150,000	Semi-active.
31	1973	750,000	Active.
32	1974	2,500,000	Active—starting.
33	1972	750,000	Active—conservative.
34	1973	7,000,000	Active.
35	1974	5,000,000	Active.
	Total	51,500,000	

TOTALS

Total venture capital available, reported as of February 1974 with 77 firms reporting:

Total Table I		$ 3,350,000
Total Table II		51,500,000
Add from Table I:		
9)	$1,000,000	
16)	2,500,000	
17)	1,750,000	
20)	4,000,000	
26)	1,500,000	
27)	300,000	
29)	75,000	
	$11,125,000	
		$11,125,000
Total funds reported available		**$65,975,000**

The 77 firms contacted include an estimated 95% or more of the industry. They reported $65,975,000 currently (Feb./March 1974) available for investment. Of the contacts made, five did not disclose their capital availability as they are part of larger pools and do not break out venture funds as such. In the Knight and Oliver study of June 1971, 17 of the 44 firms surveyed reported an availability of $64,042,000. That same group of 17 firms today (Feb./March 1974) report an availability of only $3,350,000, a decline of 94.77%. This indicates a failure to replace invested funds (this study did not attempt to establish the total actually invested by them in that period), or that the funds reported available for venture investment at that time have since been withdrawn. Regardless of where the funds went, it may be readily seen that if all of the 44 Knight and Oliver firms had answered the question "How much capital do you currently have available for investment?", the total would have been substantially higher than the $64,000,000 reported by the 17 firms who did answer. When one considers that the 77 firms surveyed in this study reported only $66,000,000 available, one must conclude that there has been a severe reduction in venture capital available in Canada over the past three years.

Geographical location of reported available funds for venture capital investment

Vancouver	$11,850,000	18.0%
Calgary	4,150,000	6.0%
Winnipeg	750,000	1.1%
London	1,000,000	1.5%
Toronto	26,400,000	40.0%
Montreal	21,825,000	33.1%
Total Canada	$65,975,000	100.0%

Ninety-one per cent of venture capital funds reported available for investment is located in three centres, Vancouver, Toronto and Montreal. Severe gaps exist in the rest of Canada, with the eastern provinces completely void of formal venture capital firms. This clustering of venture firms indicates a need to provide facilities offering wider geographical exposure and shows how the proposed FBDB could be utilized to fill some of the gaps.

The current status of the 44 original reporting companies in Table I is as follows:

Acquired by another company	2
Could not locate	2
Out of business	3
Out of field	8
Now in merchant banking	2
Fully invested	4
Investing only in U.S.	2
Now in packaging**	3
Semi–active	6
Active	12
	44

(**) See note on Table I

Twenty-six companies (59%) of the original group of 44 are now, for all practical purposes, out of the Canadian venture capital field, and another six (13.6%) are only semi-active, with only 12 (27%) of the original group reporting as active.

This is a huge attrition for such a short period of time, indicating that the life cycle of venture capital firms is quite short. Chart ''D'' analyses this phenomenon.

Two other significant factors should be noted: 1) The firms stating ''unlimited'' funds available in Table I are not normally considered to be venture capital investment firms, although they do make venture capital investments from time to time, and 2) the CDC (Canadian Development Corporation) has injected $11.5 million of new capital into three reporting firms within the past two years.

The decline in available funds is not unique in Canada for, in a recent U.S. study, [13] the position was described as follows:

> *''The recent situation of relatively depressed stock prices and high interest has reduced the availability of money in the venture capital marketplace to about 20% of what it was in 1968/69 according to the four respondents. This reflects a change in the*

yields available for risks taken. It was estimated that about $2 to $3 billion was available for high risk investments in the 1968/69 time period."

"START–UP" FINANCING

The Canadian venture capital industry does not appear to be quite as sensitive to stock market fluctuations as the U.S. industry, but as previously noted, the depressed market has had a major effect in Canada, as it has virtually closed one of the major "exits", new-issue underwriting. This condition has had its greatest impact on the financing of start-ups. Normally, start-ups are the riskiest venture investments anyway and unless a public offering can be anticipated, the investor may be locked into the investment for a long time. While start-ups cause the greatest number of management headaches and consume more of the venture capitalists' time, they can produce the best investment results, sometimes incredible results, as illustrated by the case of the Digital Equipment Corporation, the legendary investment made by American Research Foundation of $68,000, which was sold out some 13 years later for over $450,000,000.

Almost all firms interviewed indicated a substantial decline in their start-up activity while admitting that opportunities and requests have increased in number. Most firms agreed that an average of approximately 5% of funds available currently go into start-ups, although some felt this estimate was high. By eliminating firms willing to look at start-up proposals but who have never funded one, and those which stated they will not fund start-ups, the active list is reduced to 23 firms, reporting a total current availability of $43,250,000. This would **appear** to provide a start-up availability figure of $2,200,000, but closer examination belies this assumption.

It is estimated the average start-up in the U.S.A. today requires a minimum of $250,000 investment (not necessarily initially, as these investments are usually made in stages). In Canada, a more modest $150,000 plus was reported to be the minimum required.

Willingness to finance start-ups is one thing, but ability to provide sufficient funds is another. The 23 firms indicating a willingness to support this activity break down as follows:

4 firms each report $4,000,000 or more available for **all investment;**
6 firms each report $2,000,000 to $4,000,000 available for **all investment; and**
13 firms each report under $2,000,000 available for **all investment.**

If the above firms limit their start-up investments to the estimated 5% Canadian average, the availability will be as follows:

4 firms each report $200,000 or more available for start-ups;
6 firms each report $100,000 to $200,000 available for start-ups; **and**
13 firms each report **under** $100,000 available for start-ups.

This means only 10 firms in Canada are able to finance an average start-up out of their own reported available funds, providing a total of $1,725,000 for start-ups, based on the 5% estimate. All the rest must syndicate (join with other firms in the venture, a difficult thing to accomplish) in order to finance even **one** average start-up, if they stay within the average 5% figure.

So a more realistic estimate would be $1,725,000 available for all start-ups, with a fringe $425,000 divided amongst another 13 firms as support money. This is for **all** types of start-ups in Canada.

TECHNOLOGY–BASED START–UPS

Russel Knight, [14] in another study found only five of 56 (8.9%) reporting Canadian venture capital firms indicated a preference for high-technology firms (at any stage of investment). Interestingly, 40% of the American firms reporting in the same study preferred high-technology firms. In the 1971 study, Les Crane [15] found that in 149 cases of Canadian venture investments made within two years prior to interview, 28% were considered to be high-technology firms. He does not state at what stage these investments were made and those reporting represented a wide range of investing companies, the majority of which would not be normally classified as formal venture capital firms. However, 31 venture capital companies were included in the group of 149 companies and 35% of these firms stated they were ''very interested in general high technology as versus established technology''.

Accurate statistical information is in very short supply, but given the data reported above, it appears reasonable to allocate 33% of all start-up funds to technologically-based ventures.

This means, at this moment in time, approximately $650,000 is available for this type of start-up, or enough funds to establish four or five minimal-size new technology-based companies in Canada.

Litvak and Maule, [16] in a recently completed study, provided empirical data about the characteristics of some successful Canadian entrepreneurs. The 112 technologically innovative companies reporting on problems indicated:

> *''The financing of entrepreneurial operations was viewed by the respondents as the single most important problem. Eighty per cent of those identifying a specific problem explained it in terms of the conservatism of Canadian financial institutions. The symptoms of this conservatism were usually identified as financial institutions charging a relatively higher interest rate to smaller ventures, and a greater overall reluctance to issue loans to smaller firms. However, an increasing number of entrepreneurs commented that there is no general shortage of capital, but that too little of it is being channeled into entrepreneurial ventures in the form of risk capital.''*

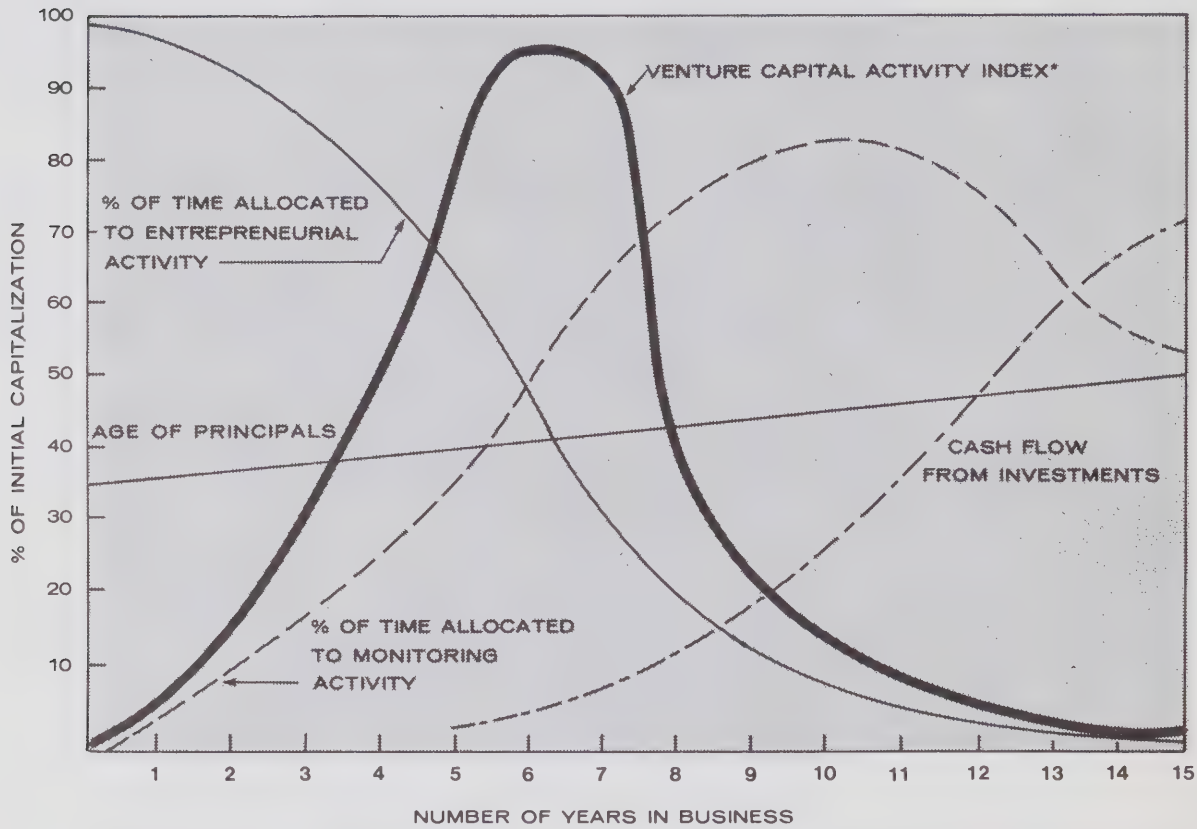
High interest rates, difficult terms, demanding equity percentages and general inability to locate capital makes the lot of the entrepreneur a difficult one indeed, and this is most evident in technologically-oriented enterprise. The average technically-oriented entrepreneur wishing to establish a new company would encounter so much difficulty, just locating funds in the Canadian venture capital industry that it would surely intimidate anyone but the most optimistic and tenacious person.

Start-up funds are in seriously short supply in Canada. This applies to *all* start-ups, but especially for new, technology-based ventures.

LIFE CYCLE OF A VENTURE CAPITAL COMPANY

The Chart below was developed to illustrate the life cycle of an average venture capital firm. It is assumed the firm was initially capitalized with a fixed sum, and involves an average number of principals (3).

CHART D



LIFE CYCLE OF A TYPICAL VENTURE CAPITAL COMPANY

****Composite index comprising investments made as a percentage of total assets over a given time span, showing the rise in investment activity followed by a decline in this activity as the firm becomes fully invested.***

Several factors tend to cause a firm to phase out of venture capital activity in five to seven years:

1. Entrepreneurial or investment activity time declines as the need for monitoring time rises.
2. Investment attitude becomes more conservative as the curve rises toward 100% investment of assets.
3. Investment attitude becomes more conservative as the age line of the principals rises.
4. Poor or bad investments are written-off or liquidated and good investments are retained, improving the firm's investment portfolio.
5. Most companies will become fully invested prior to the realization of any significant portion of their portfolio.

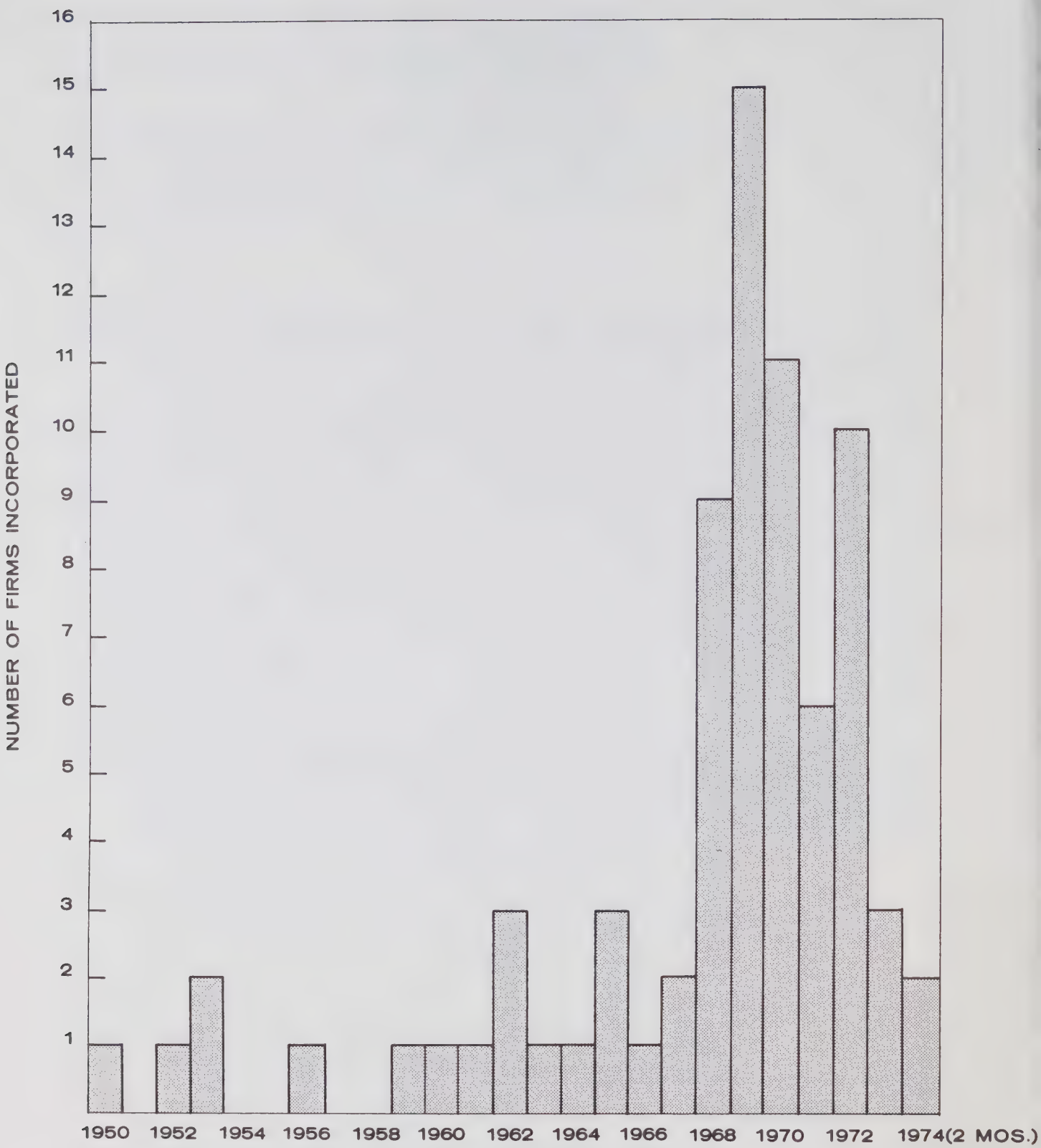
Therefore, unless new funds are injected (difficult to do on an equitable basis), the firm effectively phases out of the venture capital business and becomes a management or investment holding company.

The number of principals involved in the business is another inhibiting factor. The current Canadian average is 2.9 principals per firm. Obviously, their time for all activities is limited and ''brush fires'' in one or more of their companies have a high priority for their attention, increasing the monitoring time allocation, and decreasing entrepreneurial financing activity. The limited number of principals creates a problem when new senior personnel should be introduced to expand the firm. As the paper value of the principals' vested interest rises, it becomes more and more difficult to bring in younger men at a peer level. Even if they are able to contribute large amounts of cash (few are), they cannot purchase a share of the principals' vested time interest, unless they purchase their interest in the firm at a realistic current share evaluation. Otherwise the principals would be subsidizing their entry into the firm. It is unlikely any budding venture capitalist with funds would wish to purchase an interest in mature or semi-mature firms, as this defeats the purpose of entering the field by reducing his potential investment gain possibilities. New firm members can therefore only become a form of employee and this does not normally elicit the type of interest and dedication required to become a successful venture capitalist.

If the firm has a very large initial capitalization or a **committed** continuous inflow of funds, it will extend the venture life cycle. One well-known venture capitalist suggested an initial capitalization of at least $20 million would be required to enable the firm to remain active until the portfolio matured. The uninvested portion of the capital would be generating sufficient income in the meantime, to support a staff large enough to divide responsibilities into monitoring and entrepreneurial areas.

Heizer, in Chicago, started with $85 million initially and promptly allocated separate monitoring and entrepreneurial responsibilities to different groups to solve the problem described above. To date, no Canadian venture capital firm has been established with anything near the $20 million for initial funding.

CHART E



YEAR OF INCORPORATION OF 76 VENTURE CAPITAL FIRMS IN CANADA

Chart "E" shows the number of venture capital firms incorporated each year in Canada, but does not indicate their capitalization.

It can be seen that a surge of optimism followed the great "bull" markets of 1966-1969, leading to the formation of the largest number of venture capital firms in Canada's history. The time lag between concept and operation will always be about one year and considering this factor, the formation graph follows the stock market gyrations quite closely. The stock market is not the only factor influencing the formation of new firms. Tax environment, emerging nationalism, with its foreign takeover uncertainties, the former level of corporate profits and unsettled monetary conditions, have all taken their toll. Canada also badly needs a "Digital Equipment Corp." to spark interest again, but it is only possible to achieve this type of result after many attempts under the proper conditions.

It is important to encourage the continuous formation of new venture capital companies in Canada, if we are to depend on the industry to provide funds for entrepreneurial activity, as their life cycle appears much shorter than previously thought.

So we see some of the problems involved when a young expanding firm requires additional capital, or an entrepreneur wants to finance a new business.

But how did the young firm get there in the first place and what elements are involved in the formation of a new enterprise?

THE ENTREPRENEURIAL PHENOMENON

Entrepreneurs are a special breed. Like other creative types, they are not cast from the mould of "normal man". Does this suggest they are in some way "abnormal"? Discussions and experience indicate this is so — entrepreneurs, indeed, are different. M.E. Atkinson [17] reported this phenomenon in her paper "Factors Discriminating Between Technological Spin-Offs and Research and Development Personnel".

By measuring certain key characteristics in known successful entrepreneurs, she was able to apply the same profile to peer-level personnel in "safe" environments, such as large industry or government labs, and the comparative profiles indicated a measurable difference in personalities.

By applying the same techniques in tests on high school students, she was able to conclude that it is possible to detect embryonic entrepreneurs and further, to stimulate their development, given the opportunity and proper environment.

J. MacIntyre of the Development Research Association came to similar conclusions, and has been successful in his efforts to "create" entrepreneurs from potential candidates. Considering these findings, we should examine the possibility of improving our educational methods, especially in engineering and technical courses, to increase the number of potential entrepreneurs in Canada.

A note of caution, however, has been struck by some officials. While the success rate of experimental groups as entrepreneurs has been very high, they seem to have paid a penalty with an abnormal occurrence of ulcers, heart attacks, various stress symptoms and a high divorce rate. Possibly this is a normal state of affairs for

entrepreneurs, but it may indicate a need to refine the stimulation process to remove these adverse side affects. In any event, the experimental work appears to have merit and should be further examined for possible use in Canada.

THE ROLE OF "SEED" CAPITAL

New enterprises, whatever their nature, are born of ideas... ideas that are essentially the product of one brain. They are toyed with, analysed, dissected, re-constructed and revised, eventually reaching the stage of development planning. It is at this point, usually, that money enters the picture.

What is the potential market? What about production cost analysis? What cash flow can be anticipated on a pro forma basis? What facilities are required? What development work is needed to produce a commercial prototype? And so the questions go.

Every successful enterprise requires skills in three basic areas — finance, production and marketing. It is like a three-legged milking stool: Each leg is essential if the stool is to stand on its own. Rarely is expertise found in all three areas in one man, so regardless of the background of the entrepreneur, at some point he will probably need outside help. Unless he is very fortunate in his choice of associates, this usually means money for paid professional assistance.

Many methods have been used to acquire this initial funding, but almost all involve personal resources, either the entrepreneur's funds or his wife's, friends' or relatives'. This process worked fairly well in the days of little or no taxes, but has become increasingly inefficient as disposable incomes are reduced by inflation and growing taxation. The pre-start-up cost of developing a new business has risen along with everything else. It is becoming more and more difficult for an individual to accumulate sufficient funds for even the pre-start-up costs of a new business, much less adequate capital to actually get the firm through its early growing stages. Entrepreneurs, therefore, are more and more dependent on formalized sources of funds for this early money.

While it is recognized that personal funds are still a significant factor, it was considered impossible to quantify the amount available from this source, as the relationship of the entrepreneur to the investor (close friends, relatives, private individuals) is often the prime criterion, rather than the viability of the project or the amount of funds in the hands of the investor. Since access to these funds is often dictated by such personal, subjective relationships, it is a serious handicap to the entrepreneur.

Entrepreneurs are a true natural resource, much maligned and misunderstood in Canada, who will have an inordinate influence on the formation of new enterprises and hence the economy, provided they are given financial support and the proper environment in which to flourish.

ENTREPRENEUR/VENTURE CAPITAL INTERFACE

Venture capitalists who were interviewed during this study constantly stated that entrepreneurial proposals were often ill-prepared and inadequately researched, raising grave questions as to the managerial capability of the candidates in the minds

of the financiers. Equally, entrepreneurs complained venture capitalists were unrealistic in their demands, as most of their capital had been spent to develop the product, service or what have you, and they, therefore, did not have the resources to comply with the investors' requirements.

In a study on Canadian venture capital firms, A.C. Baillie [18] found that on the whole, American proposals were much better prepared than their Canadian counterparts. He concluded that this did not mean that Canadian entrepreneurs were not capable, but rather seemed to have failed to develop a close rapport with venture capitalists; thus each group seemed unable to communicate their needs to the other.

Three factors in this area become apparent if one compares the Canadian and American situation:

1) The average educational level of technical entrepreneurs in the U.S. is at least Master of Science level or higher (the Canadian level has not been measured, but is estimated to be significantly lower);

2) The team (an entrepreneurial group comprised of marketing, production and financial talent) approach is used far more often in the U.S. than in Canada; and

3) Relatively more early seed money is available from a greater number of sources in the U.S. than in Canada.

There are many other differences, but the above three factors are significant, possibly even critical.

The educational level is a long-term problem, requiring in-depth analysis by a host of disciplines, and as such, is beyond the scope of this study. We certainly could improve our attitudes toward higher learning, encouraging further education for everyone. This is especially important in the technological area, particularly if a student indicates an aptitude for entrepreneurial activity. One indication of a potential bottleneck for technological innovation in Canada emerged when Baillie reported the number of engineers per 10,000 population in several countries, as follows:

Canada	7
United Kingdom	11
Japan	12
Sweden	22
U.S.	25

If Canadians are to maintain a high living standard, means must be found whereby labor productivity will constantly increase. The most important element in this problem is technology, as it provides the main means to attain this goal. Technological development in turn demands an adequate supply of scientists and engineers, preferably with innovative attitudes and a strong entrepreneurial inclination.

Alex Dingee of the Institute for New Enterprise Development in Massachusetts has developed a crash training course for would-be entrepreneurs. They advertise the availability of the course in a given city, starting on a Friday evening immediately after work. The students are driven from morning to night in concentrated sessions for four weekends, analysing and developing their own business plans during the course. Dingee stated the drop-out rate is high, but the survivors are unusually successful in establishing their own businesses! No such program exists in Canada

at the present time, nor is direct assistance available to entrepreneurs for the provision of:

1) Guidance in the elements that comprise a detailed business plan;

2) Suggestions as to where special expertise may be obtained;

3) Financial support for the development of their business plan; and

4) Introduction to government and private sector sources to obtain financial support for the venture, assuming the business plan indicates it is a feasible project.

To isolate the point of greatest difficulty between entrepreneurs and venture capitalists, the latter were asked to agree or disagree with the following statement:

> *''The **earliest** possible point at which you (the venture capitalist) can prudently inject capital in a new project, especially if you are institutionally funded (as versus using personal or family funds) is **after** the development of a detailed and hopefully sophisticated business plan.''*

Every venture capitalist interviewed agreed, with one exception, and he is known for his innovative funding at an early stage.

If we are to facilitate the formation of new ventures in Canada, we must assist and encourage the entrepreneur to develop a proper business plan, both for his sake and for the venture capitalist's. The cost of this exercise may run as high as $100,000 per plan, but should average about $10,000. The plan might take anything from a month to a year to prepare, depending on the magnitude and complexity of the project.

Entrepreneurial activity can be stimulated by education and financial support in the earliest planning stages. At present, neither is available in Canada, causing an underutilization of our entrepreneurial talent.

THE RAW MATERIAL OF INNOVATION

The question was raised in an earlier section on entrepreneurs, ''Where does the new company come from?'' One should now ask, ''Where do the ideas and products come from that form the raw material for a new business, or for that matter, new industry?''

Raw material sources for technologically-based firms divide naturally into three categories: 1) Invention, 2) Development and 3) Design. As the analysis of these activities is not directly related to capital markets, the author's findings in these areas are attached as Appendix 3 of this report. Of the three, invention appears to be weakest link in the chain, at least from a support standpoint. This problem has, therefore, been explored in some detail.

THE PRIVATE INVENTOR IN CANADA

During the course of this study, approximately 200 private inventors in Canada either contacted the writer, or were contacted through organizations to which they belonged. Much was learned in personal discussions about the problems and frustrations encountered by this interesting group. This knowledge was amplified by the answers provided in a questionnaire distributed to those inventors. A sample of the questionnaire is attached as Appendix 2 of this report.

Analysis of the 82 replies received indicates:

1. Average number of inventions per inventor 6.3

2. Average number of inventions licensed per inventor 1.7

3. Average number of inventions being produced by a company in which the inventor has an interest 0.9

4. Percentage of inventions which have returned sufficient funds to repay development costs 17.3%

5. Average lifetime expenditure per inventor on all inventions $39,950

6. Average expenditure per invention by inventor ..... $ 6,186

7. Reported financial support to inventors by sector:

a)	University	0
b)	Federal government	5
c)	Provincial government	2
d)	Friends and/or relatives	18
e)	Banks or co-operatives	5
f)	Private sources in own community	10
g)	Other	12
	Reporting	52

Presumably the balance has received no financial support from any source other than personal funds.

8. Estimated funds required for development of latest invention(s).
Total reported $5,689,700

9. Average funds required for development of latest invention per inventor $69,386

10. Attitude towards business involvement:

a) "Do you wish to be involved in the business of producing your invention?"

YES	42.7%
NO	30.5%

MAYBE	4.8%
CONSULTANT ONLY	12.2%
NO ANSWER	9.8%
	100.0%

b) "Would you sell some equity in a business which produces your invention?"

YES	88.5%
NO	1.6%
UNDECIDED	9.9%
	100.0%

c) "Would you be willing to take a minority equity position in a business which produces your invention?"

YES	75.4%
NO	16.4%
UNDECIDED	8.2%
	100.0%

11. a) "Are you aware of provincial and federal government programmes currently available to support new projects?"

YES	45.1%
NO	50.0%
NO ANSWER	4.9%
	100.0%

b) "Are you eligible for assistance under any of these programmes?"

YES	22.0%
NO	15.9%
DON'T KNOW	62.1%
	100.0%

It is interesting to note the high percentage of respondents who were unaware of their eligibility for government assistance. On that point, a number of criticisms were heard during the course of this study about federal government assistance programmes. The most common were: 1) There are so many programmes it takes a long time to learn which programme applies in their case. 2) The programmes are administered by too many different departments located in too many places. 3) The degree of receptivity and assistance provided varies radically from "completely disinterested" through to "very helpful". 4) It takes far too long to receive an answer to a submission. 5) A firm committment cannot be obtained guaranteeing the follow-through of the programme. 6) Government participation is sometimes cut off

too soon, before the project has had time to reach maturity. 7) It takes too long to obtain funds after a proposal has been accepted. 8) Almost all programmes seem to give preference to large scale proposals.

As suspected, the largest single source of financial support to inventors, aside from their personal funds, was from friends and relatives, with 36% reporting assistance obtained from this source. The next largest group was private sources in their own area (19.2%), usually from shares sold in a private company. After that, the percentages become quite small, almost insignificant.

Private inventors depend on financing from personal resources, or those of friends, relatives and the private community for the vast majority of their financial requirements.

Attrition rates experienced by private inventors are similar to those encountered by formal agencies, with only 17.3% of inventions returning at least their development costs, or 88 out of 510 inventions as reported in the survey. No attempt was made to estimate the overall profitability of the exercise of invention by private inventors, but it is probably low.

The total individual expenditure on invention by private inventors is surprisingly high ($39,950), but this figure represents a lifetime total. When this is broken down to costs per invention ($6,186), the figure seems quite realistic.

NATIONAL RESEARCH AND DEVELOPMENT CORPORATION (NRDC)

The National Research and Development Corporation [19], a government funded organization founded in 1949 to support and finance United Kingdom invention and technological innovation, reports its experience from 1949 to 1973 as follows:

Inventions communicated to NRDC:

Private inventors	14,500
Public bodies	12,700
Private firms	2,850
Total	30,050
Proposals accepted	5,850
License agreements (completed)	1,750
License agreements (current)	523
Income earning inventions	753
Current projects	207

This experience indicates that 2.75% of all **ideas** proposed resulted in income-producing inventions, plus whatever results from the 207 current projects underway. Forty per cent of the proposals accepted appear to be licensed eventually (they do not state the breakdown between licensing to existing industry versus start-ups) with about 33% paying off financially. The Chairman [20] stated:

> *"One third of everything we back fails completely — is a write-off. On one in three, we get our investment back. With one project in three, we are more successful than we had hoped."*

He appears to be referring to inventions actually licensed when making that breakdown.

CANADIAN PATENTS AND DEVELOPMENT LIMITED (CPDL)

CPDL was brought into being in 1947 by the National Research Council (NRC), as a wholly owned subsidiary, to handle inventions which had accumulated in NRC, essentially from research conducted during World War II. Since that time, while it is still a subsidiary of NRC, CPDL has enlarged its scope to accommodate inventions from all government departments, some 29 Canadian universities and Provincial Science Councils.

CPDL acts as a bridge between invention arising from activities supported by government funds, and private industry, which may obtain manufacturing rights by license from CPDL. This process involves screening, encouragement, some financing, some assistance in testing and prototype building, patenting and eventually licensing to private industry or to entrepreneurs to found a new business. CPDL currently has 255 active license agreements in force.

CPDL's experience appears to be fairly consistent over the years. The figures below represent the last five years' average.

Disclosures (ideas)	250	
Filed for patent (accepted)	59	(24%)
Patents issued	47	(80%)
Licensed patents	14	(30%)
Commercial success	1.4	(10%)
Break–even	2.8	(20%)
Earn some money	7.0	(50%)
Complete write–off	2.8	(20%)

NOTE: Approximately 0.75% of CPDL's licensed patents produce outstanding commercial results, with a potential to return royalties in millions of dollars. Disclosures are increasing at an average rate of 9.5% per year, with the fiscal year 1973-74 producing 312 disclosures.

As an example of the large revenues possible, CPDL cited the pharmaceutical industry. It is estimated that 1,800 to 2,700 new compounds are discovered annually in Canada alone. Of these, approximately three in 900 are patentable and two in 900 are licensable to private industry. We therefore produce six to nine patentable compounds per year, three or four of which are licensable, and of those, it is estimated two to three will be a commercial success. This does not sound like a large number, but a successful new pharmaceutical compound may reach $75,000,000 in sales, which could pay royalties of 3% or $2,250,000 over the life of the patent!

Financing of this activity, however, runs into some large numbers, as it requires an estimated $400 per compound for preliminary testing alone, some $72,000 to $108,000 just to discover the patentable compounds, plus all the other development expenses required to bring it to a licensable stage.

This type of financing is beyond the capability of CPDL, even though support of the research teams involved would be advantageous to Canada, not to mention the value to the Canadian drug industry. As a result, most research groups have made direct

contact with large U.S. pharmaceutical producers who, unlike their Canadian cousins, do have the funds for this expensive screening process and so, these potentially successful new compounds are lost to the Canadian drug industry forever.

As reporting methods are different, and NRDC accepts and funds invention from both the public and private sector, comparison of the experience of NRDC and CPDL is difficult, but results seem to be quite similar.

		NRDC	CPDL
1.	Disclosures accepted	19.5%	24.0%
2.	Inventions licensed (a)	29.3%	30.0%
3.	Inventions earning income (b)	44.0%	30.0% (c)

a) Percentage of inventions licensed of disclosures accepted.

b) Percentage of inventions licensed.

c) CPDL estimates 30% of 2) are profitable; 50% earn some money, but not a profit; and the remaining 20% are a total loss.

FINANCING OF INVENTION IN CANADA

In an attempt to estimate the number of inventions arising in Canada annually, and the potential number of commercial possibilities, the following figures were developed using estimates from Invention Quebec, CIPAC (Copyright, Inventions and Patents Association of Canada), CPDL and private inventors.

Estimated number of private Canadian inventors (including those who have incorporated)	20,000
Estimated number of ideas produced	7,000
Estimated number of inventions created	3,000
Estimated number of potential patents	1,500
Estimated number of commercial possibilities	600
Estimated number of licenses probable	180
Estimated number of probable commercial successes	60
Estimated number of potential start–ups (new company)	30

As mentioned earlier, the attrition factor is significant. But, in the final analysis, one new company or industry created may produce huge benefits to everyone concerned, starting with the inventor and ending with the public at large.

Canadian inventors produce a significant number of inventions annually which could, if supported, be the basis for many new products and for the founding of new enterprises.

Great difficulty was encountered while attempting to estimate the "demand" for funds in Canada for invention development. An estimate was obtained by dividing the number of projects seeking financing, as reported in the sample, (55, or 67.0% of those reporting) and dividing this into the estimates of funds required ($5,689,-700) which is an average reported need per project of $103,500. If a median figure (22.1%) of CPDL and NRDC of "acceptance versus proposals" is applied to the total estimated inventions per year (3,000) and multiplied by the estimated reported need, this results in an anticipated screened demand for $68,620,000.

It must be remembered, however, that the private inventor sample represents a backlog of demand, whereas both CPDL and NRDC are current. It therefore appears reasonable to divide the above figure by three or four, to allow for the backlog, resulting in an annual demand estimate of $17,000,000 plus.

Obviously a much larger sample is required, involving far more detailed analysis to develop a more accurate figure, but it appears that, after trying several approaches, the above figure is approximately correct.

It is interesting to note that Sweden budgets approximately $20,000,000 per year for their STU (Styrelsen For Tekniskutveckling — Swedish Board for Technical Development), but it cannot be directly compared as they support other activities as well as invention.

The State of Connecticut recently established the Connecticut Product Development Corporation (CPDC) essentially on the lines of the NRDC. In fact, its director, K.E.V. Willis, was brought directly from the NRDC to form and run the organization. Its activities will involve the early financing of invention and development of invention for commercial end use, exactly as NRDC does in Britain. The initial capitalization of CPDC is $10,000,000, plus a U.S. federal government grant through the National Science Foundation of $300,000 per year for specific projects. This is the first organization in the U.S. established with public funds for this purpose. It is interesting to note that the population of Connecticut is slightly over 3,000,000 with a GSP (Gross State Product) of $20,114,000,000* in 1972.

*(Source: Federal Reserve Bank of Boston)

CAPITAL NEEDS FOR INVENTORS

Capital needs for inventors arise at each level of activity after the idea stage, as described in the Innovation Flow, Chart "A" on page 2 in the Inventive Activity column.

It is difficult to generalize about development costs of inventions as they vary radically from case to case, but it may be interesting to look at each sector with this view in mind.

INVENTION

Normally, out-of-pocket costs are relatively low at this initial point, and are usually limited to the cost of raw materials if we assume the capital cost of equipment required for experimentation has been expended. A few areas require quite elaborate equipment which is normally beyond the means of the average individual, such as milling and injection moulding machines. However, almost all equipment required for virtually any invention activity is housed in a variety of places across the country. Community colleges, provincial research labs, universities, technical schools and government labs all have well-equipped shops and labs. Some community colleges in particular, are now promoting invention activity and are making their facilities available for prototype building and testing.

PATENT SEARCH

Once an idea is conceived, the inventor should immediately undertake a patent search to establish the novelty of the concept. If this search is undertaken by a patent

attorney, it will cost about $100 in Canada and about $300 in the U.S.A. It is wise to search in Washington as many more patents are filed there, than in Ottawa.

PROTOTYPE BUILDING

Depending on the invention, the initial prototype (a working model designed to prove the concept works) may cost virtually nothing or many thousands of dollars. Normally, the inventor is able to finance a working model from his own funds, but a full scale prototype may be beyond his means if it is a large, complex invention.

LABORATORY TESTING

Most private inventors seem to run into difficulties about this point, as they have neither the financial means for professional testing, nor access to proper testing facilities. Equally, most companies are reluctant to investigate an invention thoroughly unless the concept has been properly tested and evaluated. In the U.S., unlike Canada, government labs are made available to inventors for testing purposes.

PATENTING

Frequently, inventors will seek a patent and expend funds on the most frivolous inventions. One must be suspicious of the motives of any patent attorney or professional who encourages such an expenditure, but in their defense, it is sometimes very difficult to perceive what will become commercially successful (remember the Hula Hoop). A Canadian patent will cost about $1,000 for legal fees, engineering drawings, drafting of patent application etc. If it is decided to protect the invention in most countries of the Western world, patent costs could be as high as $60,000 or more. Many private inventors complain about patent costs, especially if they are prolific inventors. It is difficult to see how these costs could be lowered significantly.

COSTING

Professional assistance is often required to develop anything but the most rudimentary cost analysis, and like all professional fee expense, it is not cheap. But costing is mandatory before any reasonable market analysis can be undertaken and the commerical feasibility of the invention estimated.

MARKET ANALYSIS

Similar to costing, market surveys can be expensive, especially if a full-scale analysis is attempted. It is rare for an inventor to conduct a market survey, unless he is planning to found a company to make his invention, and even then it is infrequently done.

REVISED PROTOTYPE

By now, the new invention has probably been through a number of design modifications and a new prototype is required. Most private inventors skip the lab testing, costing and market survey stages, going directly to revision of the prototype. Unfortunately, because they lack the training and/or the funds to go through each stage, much effort may be wasted and funds uselessly expended attempting to

develop an invention that would have been aborted if analysed further at an earlier stage.

FIELD TESTING

Again, depending on the invention, this may be modest or very costly. Resources already available in Canada could be utilized for this purpose, if the desire was present, but an agency is badly needed to break down the interface between private inventors and public bodies.

LICENSING

Many inventors have not the foggiest idea of how to go about presenting their inventions to industry, or even what reasonable royalty terms might be. Guidance by a relatively neutral body in this area seems to be needed. A few advisory firms exist in Canada, mainly offshoots or subsidiaries of American firms. Some appear to encourage inventors to spend money without due regard to the probable return to the inventor. Most of the Canadian inventions in the case of one firm, and **all** of the inventions in the case of another, are sent directly to New York, where they are presented to American industry. An official in the branch office of one large company admitted to the writer that they processed about 25 to 30 Canadian inventions a month in this manner. He also admitted that the only way Canadian inventions were ever presented to Canadian companies by his firm, was through the U.S. parent of a Canadian subsidiary.

Obviously, licensing involves more than legal agreements. An active marketing programme must be undertaken to interest industry as well. Some work in this vein is being done by the Ontario Government, but it has no funding capability at present. This activity should be centralized nationally to maximize marketing exposure.

James R. Bright, [21] Associate Dean of the Graduate School of Business, University of Texas, noted:

> *''A major weakness in our national support of the innovation process is the financing of innovations during progress after Stage 3 — Verification of Theory, up through Stage 5 — Full Scale or Field Trial.*
>
> *We do not fund this activity (invention) as an act of faith. Furthermore, we leave this search for financial support of the innovation in the hands of the inventor. During this crucial time, in effect, society expects the inventor to drop his real forte (invention) and to become promoter, entrepreneur and financier. Why should the inventor, dedicated to a technological struggle and probably already under financial stress, be expected to be an effective fund raiser? Psychologically and intellectually, he is not usually a good candidate for this job. Is it any wonder that social and economic progress is delayed?''*

As Bright's 10 ''Propositions'' were the most pertinent encountered in the literature survey conducted during this study, they have been reproduced in full as Appendix 1 of this report.

No formalized financial support is available for inventors in Canada. Failure to encourage and finance this activity appears to have contributed heavily to Canada's low international ranking as an innovative nation.

The whole invention question was summarized very well by James Young, [22] editor of Design Engineering, in an editorial in the January 1974 issue. It is reprinted herewith, with his permission.

"A Way to Help the Small Inventor"

"One of the recommendations contained in Volume 3 of the Senate Special Committee on Science Report is for assistance to the small inventor. The Report recommends that the Department of Industry, Trade and Commerce set up a task force to investigate all factors having an important effect on the individual private inventor in Canada, to consider the kind of public assistance provided by other countries in this area, and the desirability of establishing a Canadian inventors' council to assist private inventors and to act as their formal spokesman. As a rider, the report adds it should be clearly understood that the task force should include successful Canadian inventors and innovators.

The first kind of public assistance we would like to see is the manufacture of working models. As an engineering magazine, we occasionally have people come in with inventions, asking for an opinion. Some can be discounted immediately — things such as underpowered aircraft with impossibly high wing loadings, or electric cars expected to have impossibly high performance for the power available. But others fall in the 'maybe' area, where the theorists disagree. To inventors in this category, we can offer only courtesy, but little hope.

But must we prove something to be theoretically perfect before making a test model? Just last month we saw a demonstration of a new product which worked perfectly but, as the designer said, he wasn't sure just why. Several academics are now working on the theory.

We know that inventions are long shots — very few are commercial successes. But, at the same time, whole new industries have resulted from the brain-child of a lone inventor who started work in his basement.

Sweden assists its inventors by paying them a full year to work on an invention. The U.S. allows free testing of inventions in government labs. Canada gives its inventors the runaround. But it is now time that we tapped this potentially valuable source of innovation."

In summary, the entire innovation process must be supported if we are to generate more technological innovation in industry. It is similar to a schooling system. If we want more university graduates, we would logically seek to increase enrollment at all stages of the system, recognizing the attrition rate from kindergarten to university.

Technological innovation requires a large number of new ideas and concepts to produce a larger "graduating class" of successful companies and products. We do not at present support the early stages of innovation, and are therefore restricting

possibilities for the formation of new firms and the development of innovative processes.

Government assistance programmes, as presently constructed, support later stages of development, completely ignoring the earliest raw material stage. A better method is needed to stimulate the flow of innovative concepts, so industry will have a larger fund of new ideas which, with proper development, may encourage industry to introduce more innovative products and processes to the market.

Technologically innovative concepts are not created by spending money, but the withholding of funds when needed can discourage creativity. New concepts, ideas and inventions are the meat of innovation; the availability of funds can only retard or accelerate the process.

CONCLUSIONS

The Innovation Process

1) The innovation process is complex, broadly affected by social attitudes and economic trends, but is particularly sensitive to financial conditions. Three distinct areas of activity exist in the innovation flow: **inventive, entrepreneurial** and **managerial,** each requiring different expertise. It is unlikely that many single individuals will perform all three functions well.

2) Some sections of the innovation chain are inadequately supported in Canada. With federal, provincial and industry co-operation, the climate for innovation in Canada could be considerably improved.

3) Risk-aversion appears prevalent at all levels in Canada. Large companies in particular tend to resist change, especially radical change, unless they feel threatened by new technology. Even then, they usually seek transfer of technology by acquiring other firms, rather than innovating internally.

4) Government incentives are unlikely to cause large companies to change, but support programmes may provide the means whereby an aggressive company may become innovative at an earlier stage of its development than would otherwise occur.

5) The federal Government R&D assistance programmes have a number of shortcomings which restrict their effectiveness. Large proposals receive preference because a small number of large grants is easier to administer than a larger number of small ones, even though the total funds placed may be equal. There is another inherent bias toward large firms because they can afford to have their requests prepared by professionals.

6) The current world energy and raw material shortages and high prices have presented an unusual opportunity to Canada. Domestic secondary industry could enjoy unusual growth, providing capital is made available to support its expansion and development.

7) Lack of capital, or access to capital markets, is not an inhibiting factor to technological innovation for large companies, but foreign ownership of large companies is an inhibiting factor, especially for technological development.

8) The interface between 'academia' and business is much wider in Canada than in the U.S. Our university talent is under-utilized, as we fail to encourage them to consult, accept directorships and found their own firms. This is particularly true of economists, scientists, engineering specialists and business school professors.

Canadian Capital Markets

9) The Canadian public accumulates savings in very conservative vehicles, primarily debt instruments of various types and tends to hold this type of investment for long periods. Generally speaking, Canadians seem risk-averse in their investment attitudes, preferring debt over equity.

10) Canadian capital markets are becoming more institutionalized, particularly due to the increase in pension savings, and this trend is likely to continue. Since institutional investors are traditionally conservative, this change in investment management responsibility suggests the quantity of higher-risk equity capital available from the investing public may be declining. Some legislative restrictions are acting as deterrents to institutions which are contemplating higher-risk equity investments.

The Tax Environment

11) Incentives in the present system

a) The tax system is not adequately utilized as an incentive tool to encourage the formation of new industry, or to direct capital into high-risk areas to support innovative activity.

b) The recent reduction of corporate tax to 40% for manufacturing and processing firms has been beneficial for secondary industry, and particularly for small and medium size firms.

c) Rapid capital cost allowance write-off is beneficial to the innovative process.

d) The full deductibility of R&D expenses is beneficial, but not particularly stimulative,

12) Disincentives under the present tax system

a) Inventors are an unfavoured group from a tax standpoint.

b) The introduction of the capital gains tax has tended to reduce the private capital pool in Canada available for equity investment.

c) The new treatment of stock option plans as taxable earned income is a disincentive to entrepreneurial activity. Refusal to allow deduction of stock option costs to corporations is also an inhibiting factor.

d) The tax loss carry-forward limitation of five years is an undesirable restriction, particularly for new enterprises.

e) The possibility that capital gains may be taxed as corporate income in the hands of venture capital firms is a disturbing factor in the industry, with serious long-term implications.

The Underwriting Community

13) The Canadian underwriting community is not sufficiently competitive to provide a versatile marketplace for new public issues, and small local or regional underwritings are difficult to arrange because of the multi-branch underwriting house system existing in Canada. Access to public markets through underwriters is expensive and time-consuming, especially for a small firm. The Canadian financial system is not presently geared to handle small underwritings.

14) Many small firms are forced to borrow funds for capital purposes because reasonable equity funding is so difficult to obtain. This reduces their growth potential through retained earnings because of debt service costs.

The Banking System

15) A gap between capital and its users exists in Canada, particularly in the development of private placement of securities of smaller firms which is largely accomplished in other countries through merchant bank and investment bank facilities.

16) The system of multi-branch banks in Canada tends to cause Canadian bankers to be more conservative than American bankers in their local lending policies.

17) If the proposed Federal Business Development Bank (the present IDB) intends to improve the entrepreneurial climate in Canada, it will be essential for the Bank to adopt a significantly different attitude and approach to equity financing than that presently held by the IDB.

The Venture Capital Industry

18) Of 79 firms surveyed (77 of which were contacted), all of whom either are or were active in making venture capital investments over the past three years, only 46 were found to be ''active'' or ''semi-active'' in the field in Canada today. This includes several recently founded companies.

19) The venture capital industry in Canada is far more conservative than is generally thought by those outside the financial community, allocating some 95% of its funds and effort to developing existing business rather than funding start-ups. It is estimated that 33 (77%) of the 46 active firms reporting fall into the ''conservative or very conservative'' category, with 72% of the reported funds available for investment in their hands. Of the balance, only some two per cent, of the total available funds reported, is handled by the three firms (6%) classified as ''aggressive''.

20) The majority of existing venture capital firms are operating with a small current capital availability. Of the 46 firms deemed active in the field, 30 (65.2%) report $1.0 million or less currently available for investment.

21) Venture capital firms appear to have a short life cycle, probably from five to seven years, unless heavily funded initially, or are in receipt of a regular injection of new capital. Therefore, it is essential to encourage the formation of new venture capital companies or cause funds to be injected into existing venture companies, if this industry is to remain an important supplier of high risk capital. (59% of the firms surveyed in a 1971 study are now inactive in the venture capital field.)

22) It is estimated that one per cent of all proposals received by venture capitalists is actually funded. About 90% is turned down virtually out of hand, with only a cursory examination of the proposal, which suggests there is a large unsatisfied demand for high risk investment funds.

23) 91.1% of all funds reported ''available for investment'' is administered in Vancouver, Toronto and Montreal, indicating a need for wider geographical exposure in the venture capital industry.

24) The total ''funds available for investment'' in Canada reported by the 77 firms actually contacted in the course of this study was $65,975,000. As this survey

represents nearly 100% of the institutionalized venture capital industry in Canada, it appears there is a severe decline in high risk investment funds available from that industry. (17 venture capital firms reported $64,000,000 ''available for investment'' in a 1971 study, but currently report only $3,350,000 available, a decrease of 94.8% in three years.)

25) New venture start-ups represent a declining proportion of venture capitalists' activities and are estimated by the industry to attract only five per cent of the Canadian venture capitalists' available funds. By analysing the 23 firms reporting a willingness to invest in this activity, it was determined that funds available from the venture capital industry in Canada for all start-ups are just under $2,000,000. Moreover, as one-third or less of start-up funding appears to be related to technologically oriented new enterprise, it was estimated that $650,000 was available for this purpose at the time of this study. This is barely sufficient to start four or five **minimal** size firms, which seems quite an inadequate number if technological innovation is to play a meaningful part in Canada's economic growth.

Entrepreneurs

26) Entrepreneurs are a unique breed, with special personality characteristics that can be identified by testing and therefore the opportunity exists to develop their latent talents through training programmes. This is important if we are to develop more technological entrepreneurs and hence more technological innovation.

27) By venture capitalists' standards, Canadian entrepreneurs generally present inadequate proposals and business plans when seeking funds. As a consequence, many potentially viable concepts never go beyond the initial interview stage, and if they do, valuable time must be expended by the venture capitalist to help the entrepreneur develop his business plan. In order to improve the success rate of applications for funds for new ventures, means must be found to upgrade the entrepreneur's general business and management knowledge, or to assist him in putting together a good ''team''.

Inventors

28) Estimates indicate about one person in a thousand is inventive. Therefore, between 20,000 and 25,000 inventors or potential inventors are resident in Canada.

29) Invention development in Canada has been severely constrained by the lack of formalized assistance and funding.

30) Major communication and credibility problems exist at the interface between inventors, industry, and sources of risk capital. No national mechanism presently exists in Canada to provide a bridge between the three groups.

RECOMMENDATIONS

1) AN ORGANIZATION TO BE CALLED "INNOVATION CANADA" SHOULD BE FORMED, TO PROVIDE FINANCIAL SUPPORT, ENCOURAGEMENT AND GUIDANCE TO INVENTORS/INNOVATORS, IN ORDER TO BRING NEW CONCEPTS TO THE STAGE WHERE THEY MAY BE LICENSED TO INDUSTRY OR ENTREPRENEURS SO THEIR COMMERCIAL POSSIBILITIES MAY BE EXPLOITED.

A study should be undertaken to develop a business plan for the proposed organization, to identify the organization structure, scope, scale and capitalization required to reach its goals. The best screening procedure should also be determined as this has been identified as a potentially sensitive area.

As several large Canadian financial institutions have expressed an interest in investing in such a company, consideration should be given to the formation of a joint venture between the federal Government and the private sector. The corporate structure could be similar to that of the Canadian Development Corporation (CDC), but rather than offer shares to the general public initially, as is intended by the CDC, it is suggested that share offerings be restricted initially to Canadian financial institutions, possibly in blocks of $1,000,000 or more.

Restricting shareholdings to financial institutions would tend to eliminate conflict of interest that might occur if manufacturing companies were shareholders. A public offering of the Company's shares might be considered at some time in the future, especially if it becomes very profitable.

Alternatively, "Innovation Canada" might be supported entirely with public funds. Under this option, non-commercial inventions that are considered to be potentially beneficial to society but not profitable, may well receive more support than under an organization primarily funded by the private sector. However, if the Government route of capitalization is followed, the Company (Innovation Canada) should be autonomous and care should be taken to ensure that staffing is non-bureaucratic in attitude and action. Further, the Board of Directors should be drawn mainly from the private sector.

It is anticipated that Canadian Patents and Development Corporation (CPDL) would be integrated into the new organization, as its experience and portfolio of present patents and licenses would be of substantial value to the new Company.

The Company's services should be available nationally and co-ordinated with those offered by the provinces, local universities, community colleges and industry.

The Company should finance inventors in the testing and production of prototypes, patent acceptable ideas on their behalf and generally bring invention to the licensing stage. In addition, an active marketing team should seek to license the inventions to industry and entrepreneurs and joint venture with them to bring Canadian invention to a commercial development stage. Through the bridge thus formed, industry could present problems to Canadian inventors for solution, thereby giving better direction to our inventive activity.

2) A SPECIAL CORPORATE DESIGNATION SHOULD BE CREATED UNDER THE INCOME TAX ACT, NAMELY AN "ELIGIBLE VENTURE INVESTMENT", (EVI), IN ORDER TO ATTRACT HIGH-RISK INVESTMENT FUNDS TO SMALL BUSINESS AND START-UPS. INVESTMENTS IN AN EVI WOULD BECOME DEDUCTIBLE AGAINST OTHER INCOME, FOR INCOME TAX PURPOSES.

For purposes of general definition, an EVI would be a private Canadian corporation that is eligible, under the Income Tax Act, for the small business deduction. This definition should be narrowed to exclude certain small businesses that would be eligible under the income tax act definition, but which might be engaged in activities that should not properly be supported through special tax concessions, such as small finance companies and real estate developers. The definition might be further narrowed to stimulate certain segments of the economy, for example technologically based secondary industry. Under this definition, any private Canadian-controlled corporation qualifying as a small business under the Income Tax Act, which is in a type of business not specifically excluded by definition, would automatically be an EVI, regardless of its date of incorporation. However, only new investments in existing companies, made after the legislation becomes effective, would be eligible for tax deduction.

In all cases (a, b and c below) an indefinite tax loss carry-forward should be allowed, as in present capital losses. All proceeds, including the original capital, would become taxable as capital gains on subsequent disposition.

a) An Individual Investor Should Be Given An Immediate Capital Loss Deduction For His Direct Equity Investment In An EVI Corporation.

To attract high-risk investment funds from individuals, an EVI capital loss deduction would be used first against other capital gains, and then, contrary to the present provisions in the Income Tax Act, any net capital loss not otherwise absorbed would be allowed against all other income. A limiting percentage could be introduced if desired; for example, such capital loss not to be applied to more than 20% of other income. This would preclude wealthy individuals from wiping out all income tax otherwise payable.

b) An Investment In An EVI Made By A Corporation Should Be Immediately Deductible As A Capital Loss.

It is suggested the same restrictions, as put forward in (a) for individual investment, be applicable to corporations. That is, direct equity investment in an EVI could be applied against any unabsorbed net capital gain with the balance applied against other income, limited perhaps to not more than 20% of that income.

c) The Initial Public Investors In A Company that Qualifies As An EVI In All Respects Except That It Goes Public, Should Be Given Special Tax Incentives.

In order to provide access to the public market and liquidity to private investors and venture capital companies who have invested in an EVI, it is reasonable to create special tax incentives to encourage an initial public investor to buy EVI issues. The tax incentive would, once again, be an immediate capital loss equal to the

investment, which could be used against other income as in (a) and would be limited to subscribing shareholders of the issue.

3) A SPECIAL STATUS CORPORATION SHOULD BE INTRODUCED INTO THE INCOME TAX ACT, TO BE DESIGNATED "SPECIAL VENTURE CAPITAL COMPANY" TO ATTRACT TAX-EXEMPT FUNDS INTO HIGHER-RISK INVESTMENTS.

The "Special Venture Capital Company" would be treated as a partnership for income tax purposes. The corporation itself would not be taxable, but would be a conduit, passing any tax liability to the shareholders themselves. This would also provide a vehicle for a full-time professional approach to venture investments and would extend the umbrella of limited liability to the shareholders.

This vehicle is needed to stimulate the flow of tax-exempt funds, such as pension funds, into the venture capital field. If only 1% of these funds found their way into higher risk investments, $141,000,000 would be made available.

4) THE PROPOSED FEDERAL BUSINESS DEVELOPMENT BANK SHOULD BE URGED TO FORMULATE A POLICY OF FUNDING AND ASSISTING IN THE DEVELOPMENT OF BUSINESS PLANS ON BEHALF OF CANADIAN ENTREPRENEURS.

While the above recommendation is within the present IDB (FBDB) mandate, unless a specific policy is adopted this concept may not receive the attention it deserves. It is strongly recommended that a project officer be appointed in each major branch of the IDB (FBDB) to act as a guide to the entrepreneur. Screening should be done by a board consisting primarily of local businessmen, with a minority of Bank personnel involved.

The Bank should be prepared to underwrite the preparation costs of the business plan when necessary, partially or in full, agreeing to payment of consultants' fees for work performed, in return for a minor equity participation in the venture. Skills will be required in marketing, finance, accounting, law, production, engineering, designing, packaging and overall management consulting, but the entrepreneur must lead and co-ordinate the investigations.

The IDB or the proposed Federal Business Development Bank at present has the best facilities to promote, finance and assist in the development of business plans. If, however, the Bank does not enthusiastically adopt the concept and support the programme with a will, consideration should be given to developing the programme under the direction of another agency, logically the Department of Industry, Trade and Commerce.

5) A COMMON ENTRY POINT OR INFORMATION AGENCY SHOULD BE ESTABLISHED THAT IS EASILY ACCESSIBLE TO ALL CANADIAN BUSINESSMEN, PROVIDING UP—TO—DATE COMPREHENSIVE INFORMATION ON ALL FEDERAL GRANT AND ASSISTANCE PROGRAMMES. IN PARTICULAR, THE AGENCY SHOULD ASSIST SMALL BUSINESSMEN IN THE PREPARATION OF SUBMISSIONS.

A common entry point into the maze of government assistance programmes would be helpful to all parties, provided the information officers were sympathetic and understanding to the businessman's problems. Consequently, a significant amount of time would be saved and the granting of funds should become more efficient generally. Special effort should be made to assist small developing companies, especially those with a technology base which have potential for expansion. It is understood that the proposed FBDB is intended to assume this responsibility.

6) THE ENTIRE SPECTRUM OF FEDERAL ASSISTANCE TO INDUSTRY SHOULD BE STUDIED TO DETERMINE WHERE PROGRAMMES OVERLAP OR CONFLICT EXISTS. FEDERAL ASSISTANCE PROGRAMMES SHOULD BE REVIEWED FOR CONFORMITY WITH EXISTING INDUSTRIAL STRATEGIES AND CO-ORDINATED WITH PROVINCIAL PROGRAMMES.

Although each programme was conceived in order to fulfill a specific need perceived at the time of its drafting, over the years duplication and some conflict has evolved. The time has come to sit back and examine the overall impact and effectiveness of these programmes. This examination should be conducted by an impartial body without allegiance to any existing programmes.

As provincial grant and development programmes have also increased in number, the need for an improved dialogue between federal and provincial officials has become imperative. Duplications between federal and provincial governments in time, effort and funding were frequently encountered during this study. Therefore, the practice of granting funds to foreign-owned corporations should be carefully examined to make sure it does not conflict with the other government policies relating to foreign ownership and the encouragement of Canadian-owned enterprises.

7) THE SMALL BUSINESS LOANS ACT SHOULD BE IMMEDIATELY REVISED TO ALLOW 1) LOANS FOR WORKING CAPITAL PURPOSES, AND 2) ESTABLISHMENT OF A FLOATING INTEREST RATE BASED ON POINTS ABOVE CANADIAN CHARTERED BANKS' PRIME RATE.

Activity has declined under the above Act, due to the limitations of a fixed interest rate which is substantially below that of the current rates actually charged to small business. No banker, therefore, is likely to suggest a loan under the Act, as he can quite readily place his funds at a considerably higher rate, with only slightly higher risk.

If the purpose of the Act is to assist small business, then appreciation of the need for working capital loans must be accepted. At present, the Act provides for capital expenditure loans only. In the event it is not deemed possible to accept the above recommendation, then the Act should be withdrawn, as it seems to provide little useful contribution to small business today.

NOTE The recommendations and comments in items 5,6 and 7 related to government programmes are really outside the parameters of this study. However, as these programmes form a growing portion of capital planning for innovative firms, it was felt to be meaningful to report on the comments received and make appropriate recommendations.

8) LIFE INSURANCE AND CERTIFICATE SAVINGS COMPANIES SHOULD BE PERMITTED, ENCOURAGED, AND POSSIBLY OBLIGED TO INVEST A SMALL PORTION OF THEIR RESERVE REQUIREMENTS IN HIGHER-RISK AREAS.

At present, insurance companies are allowed to invest up to seven per cent of their assets in non-qualifying investments under the ''basket-clause''. These investments could include high-risk start-ups and shares of young innovative companies. Unfortunately, most insurance companies have not chosen to take full advantage of this opportunity to assist Canadian entrepreneurs. As this performance seems to exemplify the conservative investment attitude held by most of these companies, a simple increase of the ''basket-clause'' percentage would not likely cause an increase in the flow of high-risk capital in Canada.

Therefore, another approach is deemed to be necessary, specifically re-allocation of a small percentage of their reserve requirements into high-risk investments, such as EVI's and Special Venture Capital Companies.

Investment restrictions are very stringent for reserve securities, at present limiting investments to certain debt issues. Thus, in our general proclivity toward debt, we have managed to impose a severe limitation on a very major pool of capital, thereby virtually eliminating its use in any equity form. If only one per cent of reserves was directed, under federal Government specifications, to equity investment in higher-risk ventures, it would provide an additional $238,000,000 of new capital for this purpose.

It is recognized that a contingent liability would accrue to the Government if the insurance and investment certificate companies were required to make high-risk investments as described. This exposure should be minimal however, as it would only come into force if a total realization of the reserves of any one company was required, as in the case of a bankruptcy.

9) CANADIAN CHARTERED BANKS SHOULD BE ALLOWED TO HOLD CONTROLLING SHARE POSITIONS IN SEPARATELY INCORPORATED VENTURE CAPITAL COMPANIES.

The Toronto-Dominion Bank is directly active in the venture field, through the T-D Capital Group which operates as a section of the Bank. To date, no other chartered bank has chosen to directly participate in this activity, but more may be encouraged to do so if they are allowed a controlling position in a venture capital subsidiary. Exemptions from present Bank Act restrictions would allow the banks to limit their liability while exercising policy control over the venture capital company, which they are unable to do under present regulations.

10) THE CURRENT PREFERENTIAL CORPORATE TAX RATE TO MANUFACTURERS AND PROCESSORS SHOULD BE CONTINUED.

The incentives provided by the lower tax rate to secondary industry provide an additional flow of earnings which may be put to use by management in many forms. In the long term, it is probably academic whether new jobs are created directly, plant facilities are updated, manufacturing capabilities expanded or new capital attracted to this sector because of added profitability. All of these factors are potentially beneficial to the economy, but particularly so to small, growing companies.

11) THE PRESENT RAPID WRITE-OFF OF CAPITAL EXPENDITURES ON FIXED ASSETS (CAPITAL COST ALLOWANCE) USED IN THE MANUFACTURE AND PROCESSING OF GOODS SHOULD BE MAINTAINED.

Accelerated depreciation encourages the expenditure of funds for new capital equipment, creating a modest incentive for technological innovation. While it is unlikely this factor alone would cause a company to become innovative, it could be the deciding factor in the decision to proceed with a new project.

12) IN ORDER TO PROMOTE INVENTION, THE DEFINITION "SCIENTIFIC RESEARCH" UNDER THE INCOME TAX ACT SHOULD BE INTERPRETED TO ALLOW MORE GENEROUS DEDUCTIONS AGAINST THE ORDINARY INCOME OF INDIVIDUALS OF THE EXPENSES INCURRED RELATED TO INVENTIVE ACTIVITY.

Inventive activity in Canada should be encouraged. The modest incentive that would be provided by allowing tax deduction of direct costs for materials, testing, legal assistance and patenting would be helpful in this regard. The difficulty of differentiating between hobby and invention is recognized, but this is a minor problem relative to the possible benefits accruing to Canada through increased invention activity. Although this is theoretically possible under the present regulations, a more liberal application is desirable. Quite possibly a criterion of patent application could be required before development cost deduction would be allowed, but a retroactive claim should be accepted in this case, as sometimes many years of development are required before bringing the invention to the patent application stage.

13) TAX TREATMENT OF STOCK OPTION BENEFITS IN THE HANDS OF EMPLOYEES SHOULD BE AMENDED SO AS TO PROVIDE AN INCENTIVE TO ENTREPRENEURS AND THEIR KEY EMPLOYEES.

The present practice of not allowing corporations to deduct the cost of stock options granted to employees, and the treating of the options in the hands of the employee as earned income, should be revised, at least for new manufacturing and processing companies. The present practice acts as an inhibiting factor in entrepreneurial activity, as stock options are a common form of rewarding key employees without the need to use earnings or capital. Very often a reasonable stock option is the determining factor in attracting essential personnel to a new enterprise, especially in the technological area.

14) THE FIVE YEAR LIMITATION ON THE CARRY-FORWARD OF NON-CAPITAL LOSSES SHOULD BE REMOVED AND REPLACED WITH AN INDEFINITE CARRY-FORWARD FOR COMPANIES THAT QUALIFY AS SMALL BUSINESSES UNDER THE INCOME TAX ACT.

Most new enterprises based on technological innovation will require a substantial time period to become profitable. When a profit is finally created, it is often minimal in the early years. The innovating company, therefore, may be deprived of the opportunity to charge previous losses against current income within the present five year carry-forward period. This can be an inhibiting factor in the decision to implement a new project or establish a new company, especially one involving technical development.

15) VENTURE CAPITAL COMPANIES SHOULD BE ACCORDED CAPITAL GAINS TREATMENT ON THEIR VENTURE INVESTMENTS.

The current lack of clear ruling on whether venture capital companies will be taxed on realized capital gains as ordinary corporate income is creating confusion in the industry. Venture capital companies should be allowed to value their portfolio of investments annually either at cost or current market value, whichever is lower, thereby allowing early tax recognition of unrealized losses. Failure to allow capital gains treatment will have a very serious effect, quite possibly causing the complete demise of the venture capital industry in Canada.

16) EDUCATIONAL PROGRAMMES FOR ENTREPRENEURS SHOULD BE ESTABLISHED TO TEACH THE BASIC ELEMENTS OF STARTING A NEW ENTERPRISE.

As mentioned in the general body of this report, experimental programmes in entrepreneurial stimulation and education are under way in the USA. Their experiments indicate a worthwhile return for effort and monies expended and should be studied for possible Canadian adaptation. Very few courses are offered in Canadian universities which are pertinent to establishing a new enterprise, even for M.B.A. students. Courses could be offered in universities, community colleges, in IDB branches or sponsored separately by the government.

17) MEANS SHOULD BE PROVIDED TO ENSURE THAT PATENTABLE CONCEPTS DISCOVERED IN THE COURSE OF UNIVERSITY RESEARCH SHOULD BE MADE AVAILABLE TO CANADIAN ENTREPRENEURS FOR COMMERCIAL DEVELOPMENT.

A better system is required to bridge the gap between universities and the business community. There is little communication between the two groups and until a greater involvement can be effected, an organization which acts as a broker/intermediary appears necessary. Canadian Patents and Development Limited is filling this role in a limited way, but does not seem to have the strong support and involvement required to fully tap this source of talent.

18) A SYSTEM OF ANNUAL AWARDS SHOULD BE ESTABLISHED FOR CANADIAN INVENTORS.

Inventive activity is not highly regarded in Canada, therefore, it seems likely a system of recognition would improve the social image of inventors. It is proposed that a prestigious national board of examiners be established, to annually select the best Canadian invention in several technical categories, each winner to be awarded an amount of $10,000 tax free. The winners in each category would then compete for a grand award of $50,000 tax free. A silver medal should be struck for each category winner and a gold medal struck for the grand award. It is especially recommended that one category be limited to "junior" entrants under 18 years of age. This would encourage the development of inventive activity in our youth so Canada may some day gain a higher international position as an innovative nation. The awards should be presented by the Governor General or the Prime Minister, with appropriate publicity, indicating national recognition of creative inventive talent, thereby finally giving national recognition to a segment of our populace whose contributions have long been ignored.

APPENDIX 1

Propositions of J.R. Bright, [23]
Associate Dean of the Graduate School of Business,
University of Texas

The following statements, arranged as "propositions" with accompanying "conclusions", summarize the problems involved in bringing a new invention and innovation to a commercial reality.

Proposition 1. *Technological innovation — the process of translating technical knowledge into economic reality — involves four major functions:*

a) The ***scientific*** *(search for knowledge);*

b) The ***engineering*** *(reduction to practice);*

c) The ***entrepreneurial*** *(introduction to society); and*

d) The ***managerial*** *(optimization of usage).*

Conclusion. *Management must realize that an innovation requires these four types of activities, roughly in the sequences mentioned. In proceeding with a radical technological innovation, management must continually assess the current leadership needs of the innovation process, and it must nurture the project by providing the necessary skills and leadership at the right times.*

Proposition 2. *The full process of technological innovation takes upwards of 10 years, and a quarter of a century is not an uncommon time.*

Bright then further subdivides the process of technological innovation into eight divisions:

1) Scientific Suggestion, Discovery and Observation, or Recognition of Need;

2) Development of Theory or Design Concept;

3) Laboratory Verification of Theory or Design Concept;

4) Laboratory Demonstration of Application;

5) Field Trial or Full Scale Trial;

6) Commercial Introduction;

7) Widespread Adoption; and

8) Proliferation or Commercial Diffusion.

Conclusion. *Management decisions about radical technological innovations need to be made with an entirely different value system than is applied to most business problems. We are dealing with a ten to twenty-five year process, and it is wrong to use conventional business wisdom when relating oneself to this long process of* ***radical*** *technological innovation.*

Proposition 3. *Radical innovations often originate outside the traditional supplier-user sources.*

Conclusion. *Firms and governments should develop and exhibit more interest, respect and methodology in* ***searching*** *for technological opportunity and threat outside the traditional and logical sources, and among people who may have little in the way of conventional technical credibility. All managers, particularly older senior men who have built great enterprises around new technology, should be given periodic reminders that the technology that will replace theirs may well originate outside their industry.*

Proposition 4. *The most important application of a new technology is not always that which was visualized first, and a corollary: technological innovations frequently gain their first foothold for purposes that were orginally not thought of or were deemed to be secondary.*

Conclusion. *The sponsors of a radical technology should adopt a policy of searching for applications, with an open mind toward new uses and a readiness to support trials in unexpected fields. The strategy should be one of exploration, rather than one of single-minded commitment to one pre-determined usage. Therefore, market research studies should be taken with a very large grain of salt, for it is dubious that any one small group can imagine or discover the potential uses of a radical innovation that all of society will uncover. This is particularly true because other new technology and social developments create future needs that were unimagined when the early studies were made. The market we can foresee is likely to be drastically altered by changes during the decade in which the innovation grows to reality.*

Proposition 5. *Technological capabilities and parameters (such as power, speed, strength, etc.) advance in an exponential manner over time.*

Conclusion. *In estimating future achievement, the nature of this exponential curve must be remembered. ''Straight line'' progress can be anticipated initially, but when the crucial technical breakthroughs are made, progress will explode.*

Proposition 6. *Advances in technological capabilities often reach points of diminishing economic returns.*

Conclusion. *The immediate application of every additional technological gain may not have much economic value. However, the reason for this seems to be that other parts of the system (or society) are not yet in a position to benefit from the gain. In addition to the need for proper timing of the introduction, this proposition points to new opportunities in improving the ends of the system that are reducing the advantages of the advance.*

Proposition 7. *Accelerated and often unexpected progress comes about due to the impingement and convergence of one technology on another.*

Conclusion. *Many erroneous rejections of new technical possibilities or their markets occur because we tend to hold all other technology constant. We must always examine the possibility that other technological elements are also subject to exponential progress, and so may rapidly change the merits or feasibility of a particular technological innovation.*

Proposition 8. *The demonstration of a new technological concept is a most critical point to the progress of an innovation.*

Conclusion. *We need greater skill and thoughtfulness in appraising demonstrations.*

Proposition 9. *The mode of financing usage of the innovation is of utmost significance to the rate of diffusion and to the financial returns to the innovating firm.*

Conclusion. *The design of the method of charging for the use of the innovation deserves far more attention than it normally receives.*

Proposition 10. *A major weakness in our national support of the innovative process is the financing of innovations during progress after Stage 3 — Verification of Theory, up through Stage 5 — Full Scale or Field Trial.*

Conclusion. *We do not fund this activity (invention) as an act of faith. Furthermore, we leave this search for financial support of the innovation in the hands of the inventor. During this crucial time, in effect, society expects the inventor to drop his real forte (invention) and to become promoter, entrepreneur and financier. Why should the inventor, dedicated to a technological struggle and probably already under financial stress, be expected to be an effective fund raiser? Psychologically and intellectually, he is not usually a good candidate for this job. Is it any wonder that social and economic progress is delayed?*

APPENDIX 2: QUESTIONNAIRE TO INVENTORS

February 8, 1974

Dear Friend,

As you have expressed an interest in the study which I am conducting, possibly you would be good enough to take a few minutes to answer the following questions. The replies will provide some tangible evidence of the need for assistance to inventors.

1) Number of your inventions to date _____

2) a. Number of inventions licensed _____

b. Number of inventions being produced by a company in which you have an interest _____

c. Number of inventions above, which have been produced in sufficient volume to repay the cost of development _____

3) a. Estimated personal expenditures for all inventions to date _____

b. Estimated difference between expenditures and receipts from licensing or production _____

4) Have you received funds to support your inventions from

a. University _____

b. Federal Government _____

c. Provincial Government _____

d. Friends and/or relatives _____

e. Banks or co-operatives _____

f. Private sources in own community _____

g. Other sources (please state type) _____

_____

_____

5) If financial assistance were available now, how much do you estimate you would require to bring your latest project through each of the succeeding phases leading to its introduction to the market?

6) What would be the breakdown of the use of funds, by amount? (e.g. build prototype, test prototype, market study, market testing, preparation of business plan, pre-production expenses such as detailed design and engineering)

7) How long do you feel it would take, assuming adequate funding were available, for your latest project to be sufficiently developed and adequate supporting studies completed (such as market surveys), and the product introduced into the market?

8) Do you wish to be involved in the business of producing your invention for the market and, if so, in what capacity?

9) If you wish to be involved in the business which produces your invention, are you willing to give up some of the equity (control) of that business? Would you be willing to take a minority position?

10) Are you aware of the provincial and federal government programmes which are currently available to support the development of new projects and programmes?

_____

11) Are you eligible for assistance under any of these programmes?

_____

_____

Thank you for your early response, and please accept my apology for the form letter but time is now pressing!

Yours very truly,

Robert H. Grasley

Please return to 69 Melrose Ave.,
Toronto M5M 1Y6 — 416/487-5928

APPENDIX 3:
INVENTORS AND INVENTIONS, THE RAW MATERIAL FOR INNOVATION

During the course of this study, a great deal of information was obtained about inventors and the process of invention. As mentioned in the body of the report, this subject was not directly pertinent to capital markets for technological innovation, but as it is of general interest to technological innovation itself, the information is presented as an appendix.

The raw material for technological innovation may be divided into the following categories:

1) **Invention**

   a) Basic or absolutely new invention
   b) Development invention
   c) Invention around invention

2) **Research**

3) **Development**

   a) Engineering Development
   b) Engineering Design

4) **Design**

   a) Cosmetic design
   b) Functional design

1a) It has been said that new invention displaces no existing product, but may cause the creation of new industries without major dislocations in the economy. New companies may be created that demand completely new skills. An example is the computer, where thirty years ago various skills such as programmer, software designer and so on, were unknown, but today thousands of people are involved in designing, selling, building, operating and servicing computers.

New invention is rare, which quite possibly is fortunate, as society is only able to absorb so much new technology in a given time period. Interestingly, the worth of new and radical invention is often not recognized immediately, and is frequently dismissed by the scientific community of the time. Public statements by leading scientists of the day stated unequivocally, ''Bell's claims are absurd, it is physically impossible to transmit the human voice through a wire''.

Unfortunately, while we forget them later, we usually are all too ready at the time to listen to the ''expert'' disclaimers when faced with something radically new.

1b) Development invention is often accomplished in R&D labs and is usually the result of a discovery that a basic patent does not cover all aspects of the invention's possible use, or engineering development will uncover certain other patentable facets. Well-known products are usually protected by a group of patents; for example, Xerography is covered by some 27 patents, 26 of which were developments of the original or basic patent. These are important but almost always minor inventions.

1c) Invention around invention is also quite common. This is a way of breaking the patent protection on a basic invention, where the original patent did not cover all aspects of its possible use, or where a means of accomplishing the same result is made possible by using methods sufficiently different so as not to violate the original patent. Invention around invention is only made possible by the original basic invention stimulating the idea for another approach, one unfortunately not seen by the original inventor.

2) Research, the ''R'' portion of ''R & D'', in its purest form simply seeks to extend man's knowledge. The main contribution to innovation by research is through the discovery of new scientific principles, compounds and materials, important in its own right, but not the prime source of technological innovations.

Development invention sometimes results from a research discovery. An example of this would be the building of the first operational laser in 1959, made possible by using scientific principles discovered many years before. Patents may be granted on the ''invention'' (the invention is new, it simply utilizes known scientific principles) but without the research discovery, the invention could not have evolved.

3a) Engineering Development is in a completely different category to invention, as it represents the applied engineering evolution of an invention and consumes the largest portion of R & D expenditure today. We have had second, third and fourth generation computers, each an improvement of the other or designed to perform a different function, but simply an **extension** of the original concept. Engineering Development is often technologically ingenious, and possibly even innovative, but it is not inventive. Sometimes a new use or application for an invention is discovered through engineering development, which may become the basis for a new product or company.

3b) Engineering Design tends to blur with development, but may cause the formation of a new enterprise. It can stem from the availability of a new material (nylon for gears, for example) where by using new materials in a new way, a better product can be made. Most engineering design is intended to make the product or process more acceptable commercially by making it stronger, faster, lighter, etc.

4a) Cosmetic Design changes a previously known product superficially, giving it a greater esthetic appeal, thereby making the product more acceptable commercially.

4b) Functional Design often improves a product so it is more useful or works better and is closely allied to engineering design.

Design may be the stimulating force for formation of a new enterprise, whether cosmetic or functional (sometimes both) or may trigger a surge of expansion in an existing company. Some industries are almost wholly dependent on their design capability and many new companies have risen to eminence based solely on their re-design of existing products.

The risk factor declines as we go from section to section. The greatest financial risk but **potentially** the greatest reward, lies in the backing of basic new invention and the least risk in re-design. When examining the financial aspects of raw material for new enterprise, it becomes apparent that the risk/reward ratio affects the availability of funds, especially considering the potential time lapse before a radical innovation can be developed to the stage of commercial diffusion and hence profitability.

BASIC NEW INVENTION - MAJOR

80 %

Individual Inventor & Small Companies

15 %

Research Associations & Publicly Funded Laboratories

5 %

Large Companies

DEVELOPMENT INVENTION

40 %

Individual Inventor & Small Companies

50 %

Research Associations & Publicly Funded Laboratories

10 %

Large Companies

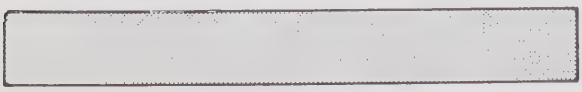
INVENTION AROUND INVENTION - MINOR

10 %

Individual Inventor & Small Companies

30 %

Research Associations & Publicly Funded Laboratories



60 %

Large Companies

ESTIMATES OF SOURCE MATERIAL FOR TECHNOLOGICAL DEVELOPMENT

It is very difficult to obtain hard data to support the estimates in Chart "F", but it serves to illustrate that different types of invention arise from different sources. Each type is valid and useful, but it must be remembered that **all** basic new invention is the product of one brain, whether the individual works on his own, for a lab or for a large company. Interestingly, a high percentage of basic invention has come from people outside of the field entirely. For example, the Kodachrome process was invented by two musicians. Gillette was a salesman of corks. Eastman (the photography genius) was a bookkeeper, and Carlson who invented xerography was a patent lawyer. An undertaker invented the automatic telephone and the inventor of the ball point pen was a sculptor, painter and journalist — and on and on the list goes.

The main lesson to be learned from this is that large companies rarely create a climate conducive to invention, and that many basic new inventions are made by independent minds working on their own time. The inventor working on basic or new invention may work for a large company (after all, he has to eat), but rarely does he work at inventing **for** them.

The U.S. Department of Commerce in their report entitled "Technological Innovation: Its Environment and Management" [24] found that "independent inventors (including inventors/entrepreneurs) and small technologically-based companies" were responsible for a substantial percentage of the important inventions and innovations of this century.

> Professor John Jewkes, [25] et al, showed that out of 61 important inventions and innovations of the 20th century, which the authors selected for analysis, over half of them stemmed from independent inventors or small firms.
>
> Professor Merton Peck [26] of Harvard studied 149 inventions in aluminum welding, fabricating techniques and aluminum finishing. Major producers accounted for only one of seven important inventions.
>
> Professor Hamberg [27] studied 13 major innovations in the American steel industry — four came from inventions in European companies, seven from independent inventors, and none from inventions by the American steel companies.
>
> Professor John Enos [28] of the Massachusetts Institute of Technology studied what were considered seven major inventions in the refining and cracking of petroleum — all seven were made by independent inventors. The contributions of major companies were largely in the area of improvement inventions.

The following table, which is based on the above studies, illustrates some of the important inventive contributions made by independent inventors and small companies in this century. The range and diversity of these inventions is impressive. Indeed, the mercury dry cells used in electronic watches, hearing aids, cameras and other fine electronic components, home air conditioners, automobile power steering, FM radio circuits and vacuum tubes, electrostatic-copying machines, penicillin and streptomycin — all of these inventions which are usually taken for granted, take on a new meaning when their sources are identified. The point is that independent inventors and small firms are responsible for an important part of our inventive process, a larger percentage than their relatively small investment in R & D would suggest.

SOME IMPORTANT INVENTIVE CONTRIBUTIONS OF INDEPENDENT INVENTORS AND SMALL ORGANIZATIONS IN THE TWENTIETH CENTURY

INVENTION	INVENTOR
Xerography	Chester Carlson
DDT	J.R. Geigy & Co.
Insulin	Frederich Banting
Vacuum tube	Lee De Forest
Rockets	Robert Goddard
Streptomycin	Selman Waksman
Penicillin	Alexander Fleming
Titanium	W.J. Kroll
Shell molding	Johannes Croning
Cyclotron	Ernest O. Lawrence
Cotton picker	John & Mack Rust
Shrink–proof knitted wear	Richard Walton
Dacron polyester fiber "Terylene"	J.R. Whinfield/ J.T. Dickson
Catalytic cracking of petroleum	Eugene Houdry
Zipper	Whitcomb Judson/ Gideon Sundback
Automatic transmission	H.F. Hobbs
Gyrocompass	A. Kaempfe/E.A. Sperry/S.G. Brown
Jet engine	Frank Whittle/ Hans von Ohain
FM radio	Edwin Armstrong
Self–winding wristwatch	John Harwood
Continuous hot–strip rolling of steel	John B. Tytus
Helicopter	Juan de la Cierva/ H. Focke/Igor Sikorsky
Mercury dry cell	Samuel Ruben
Power steering	Francis Davis
Kodachrome	L. Mannes/ L. Godowsky, Jr.
Air conditioning	Willis Carrier
Polaroid camera	Edwin Land
Heterodyne radio	Reginald Fessenden
Ball point pen	Ladislas and George Biro
Cellophane	Jacques Brandenberger
Tungsten carbide	Karl Schroeter
Bakelite	Leo Baekeland
Oxygen steel–making process	C.V. Schwartz/ J. Miles/R. Burrer
Velcro fasteners	George de Mestral
Hovercraft	Christopher Cockerell

These are some outstanding examples of well known products and processes, but are by no means all the major or important inventions emanating from individual inventors or small companies.

Individual inventors and small companies are generally underrated as to their contribution to major invention which can result in significant industrial changes.

CREATIVITY AS A NATIONAL RESOURCE

During the course of this study, some pretty wild and woolly ideas and inventions (plus some truly excellent ones as well) were presented to the author, but it is important to recognize that the producers of those ideas are creative people. They may only require encouragement and a nudge in the right direction to produce something truly beneficial for society. Estimates indicate (subjectively, not empirically) that while the majority of a given populace has some creative talent, only some five per cent utilize their talent to the point of producing actual coherent formulated ideas.

Of that group, only one-tenth of one per cent, or one in a thousand get around to translating the idea into something tangible (invention) or at least something that **may** be invention. It often happens that an inventor has ''re-invented the wheel''. Jacob Rabinow [29] (one of America's most prolific inventors who holds over 280 patents) tells of an experience he had in this regard:

> *''He (the patent examiner) sat in a small office surrounded by 'shoes', which were full of patents in his particular art. I explained to the venerable gentleman that I had a system of three-dimensional movies where one eye sees the odd pictures and the other eye the even pictures as the successive pictures are projected on the screen. I had a revolving shutter in front of the face of the viewer to select the pictures. The examiner listened and then, without looking, picked up a patent and said — 'like this?' and there was my invention, with my exact drawing, dated 1910, the year I was born. I never got over the shock. What left me thunderstruck was that the drawing was identical with my sketch. If I had not seen the date, I would have sworn that the other inventor stole it from me.''*

Hopefully, the inventor learns early to do a patent search before embarking on any expense!

There lies an unstructured spectrum of talent, indeed, within the estimated one-tenth of one per cent of our population who are inventors. During this study, sufficient contact was made with inventors to tentatively classify this heterogeneous group into three basic categories:

1. The **''one-off'' inventor.** All inventors seem to go through this phase, graduating as a rule after their first or second invention. To this group, regardless of the idea, it is thought to be ''worth a million dollars'' and almost always ''everyone is trying to steal it'' although ironically, the inventor usually finds it impossible to sell.

2. A **''multiple'' inventor.** By now, he has worked his way through several inventions, sometimes ten or more. He hits an idea that friends and relatives

enthuse over, but again, he finds it hard to entice manufacturers into buying. Depending on his bent, he may obtain some small financial support (or bleed his own bank account) and enter a new field, that of the entrepreneur, although he rarely recognizes that he has changed horses. He starts a company to make his widget, but sadly, this effort is almost always doomed to failure because he is an inventor, not an entrepreneur. Sometimes he bypasses this activity, and becomes:

3. A "**professional" inventor.** This man recognizes his talent and consciously decides to stay within his field. Some inventors seem to graduate very quickly to this category but almost all of these have had professional training. All those encountered in this group were graduate engineers or scientists of some type, often with post-graduate degrees. This does not mean to imply that university training is mandatory to become a "professional" inventor, but it does suggest that the concept of professionalism acquired at university causes a graduate to stay within his field and practice his profession, rather than enter a field of endeavour (entrepreneurial activity) where he has little training or aptitude. The same comment applies to the often-perceived hesitancy of all professionally trained people to start their own business.

As suggested earlier, technological development should be viewed as a continuous process beginning with a large input of ideas which suffer substantial attrition as they move through the filter of invention, patenting, testing, prototype building, more testing, licensing of invention, then either acceptance by existing industry through licensing of some type, or development of a new enterprise via entrepreneurial activity.

It will be recalled that when invention is licensed to industry, significant development work will almost always be required: testing, commercial prototype, design, market research, market testing, tooling for production, preparation of sales materials, costing and so on. At any point, up to and including initial market reaction, the project may have to be aborted.

In the case of a start-up, in addition to the above, a business plan must be developed covering all the items listed in Chart 'A' and, most important, financing must be obtained. Then the procedures necessary for establishing a new company must be completed, which include hiring, housing of the enterprise, purchasing, designing and implementation of systems and so on. At any time up to and even after initial entry in the market, the new enterprise may fail.

Conclusions on Invention

1) Invention divides naturally into three fundamental categories: i) Basic or completely new, ii) development invention, based on an extension of a known principle or basic invention and, iii) invention around invention.

2) The source of the three invention categories varies substantially, with private or individual inventors creating most of the basic inventions, R&D labs and individuals sharing most of the development inventions, and larger companies creating the bulk of inventions around inventions.

3) A high proportion of significant inventions has resulted from the efforts of individuals, often working completely outside of their fields. Equally, many special-

ized major industrial innovations have been developed by individuals outside of the industries concerned.

4) While Canada has not ranked high internationally in the creation of major innovations over the past decade or so, all indications suggest we have an incipient body of inventive talent resident in Canada that, given proper encouragement and financing, could produce many useful and even major inventions.

APPENDIX 4

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